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CONTENTS

Broiler Nutrition With Reference to Energy: Protein Ratios and their Influence on Growth, Food Conservation and Profit
D. Guttridge 280

Long Term Effects of Feeding Antibiotics
R. C. Jennings 284

An Account of a Serious Infestation with Gapeworms (*Syngamus Trachea*) in Growing Turkeys
P. L. Long 288

Inorganic Iodine is Not the Factor in Fish Meal Which Depresses Hatchability
A. Marsden, R. C. Jennings and R. S. Martin 291

The Application of "Flash Lighting" to Egg Production on the Deep Litter System
P. Matthews 303

High Level Antibiotic Supplementation of Poultry Foods
W. M. McKay 306

Some Observations on the Haemorrhagic Syndrome in Chicks
C. C. Wannop 310

Review of Poultry Publications 316

Notices to Members of the Association 341

BROILER NUTRITION WITH REFERENCE TO ENERGY: PROTEIN RATIOS AND THEIR INFLUENCE ON GROWTH, FOOD CONVERSION AND PROFIT*

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Broiler production is now a thriving branch of our Poultry Industry, yet the volume of recent literature on the nutrition of the chick under United Kingdom conditions is to say the least scanty. It was with this thought in mind that we recently commenced a series of nutrition experiments at the Kesteven Farm Institute. The results of the initial experiment I am presenting to you today in simplified form, together with some economic aspects which are in fact incidental to the main work which should be of some interest.

May I set the scene? American research to which we turn for much guidance naturally is devoted to American conditions. To the farmer "over there" maize and soybean meal are in plentiful supply and much is known about making the best use of them using the minimum of animal protein. As you realise we are more favourably placed in the supply of wheat than maize and in animal protein than in the American farmer. Our nutrition problems clearly differ.

THE EXPERIMENTS

Our home made broiler house has 500 sq. ft. of floor space, no windows and is ventilated by an extractor fan. In it we placed 500 D.O. as hatched RIR X LS and LS X RIR chicks, gas brooded in three equal compartments. Three rations as shown in Table I. were fed ad lib. . Note that Wheat was the sole cereal and that the quantities of Fish and Soyabean meal were varied equally to obtain calculated Crude Protein contents of about 26½, 22½ and 18½% respectively. Varying levels of Tallow (assumed P.E. 2900 Cals/lb.) were included to compensate for changes in energy content. 1000 Cals/lb (Fraps) was chosen as a convenient arbitrary level for each ration. Thus you observe the Productive Energy: Crude Protein ratios to be 37, 44 and 54: 1 respectively. Each ration was considered to contain adequate amounts of all known minerals and vitamins (possibly except Choline) and differs only in respect of protein content.

The Results

Records of live weight and food consumption (Table 2.)

* Presented at the meeting of the United Kingdom Branch of the World's Poultry Science Association held at London, England, March 29, 1957.

TABLE I. EXPERIMENTAL RATIONS

	No. 1	No. 2	No. 3
Course Ground Wheat (Atle.)	54	64	74
Extracted Soyabean Meal	17	12	7
White Fishmeal	17	12	7
Dried Lucerne Meal	2	2	2
Unextracted Dried Yeast	3	3	3
No. 1. C. R. Tallow	6	5	4
Mineral Mix. (Churn 103.)	1	2	3
	100	100	100
Calculated Analysis.			
Crude Protein %	26.8	22.7	18.5
Productive Energy (Cals/lb)	1004	1000	999
Cal/Protein Ratio	37:1	44.1	54:1
d.l.Menthionine %	.58	.48	.37
The following Premix was included in each ration (lbs. per ton.)			
Vit. A.D3. and B2. mix (Trelcovite)		4.	
Antibiotic (Aurofac 2A.)		4	
D.P.P.D.		2.6	
Manganese Sulphate		.6	
Nicarbazin 25% (Nicoxin)		1.175	

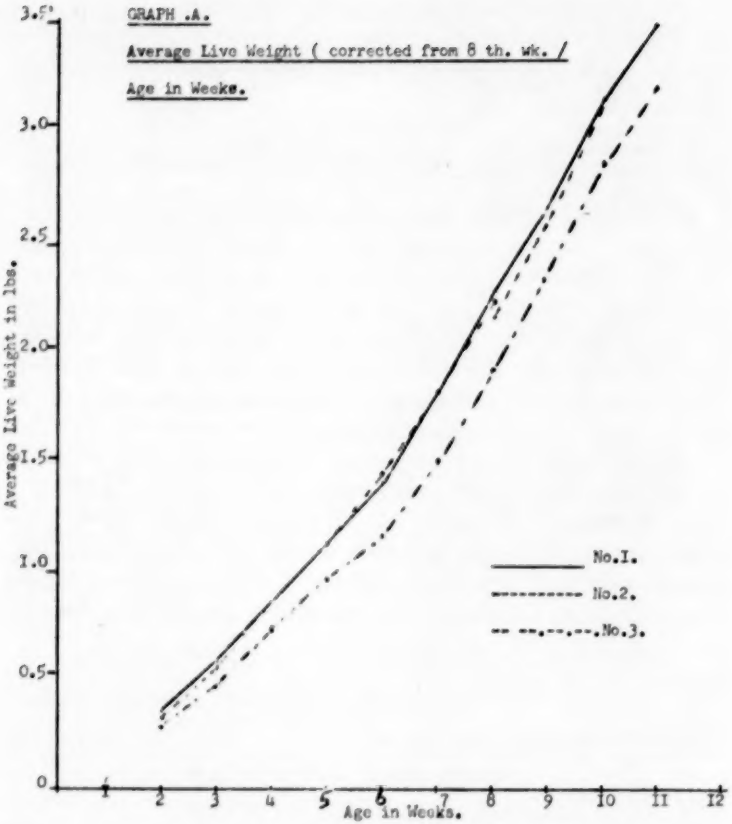
were made each week. At eight weeks the groups were subdivided and half provided with an ad lib. supply of whole Wheat together with meal, the remaining group being treated

TABLE 2. LIVE WEIGHTS AND FOOD CONVERSIONS

	Meal groups			Meal and Wheat		
Equal numbers of males and females	1	2	3	1A	2A	3A
To 8 weeks of age:— Live weight (lbs)	2.26	2.24	1.92			
Lbs food/lb L.W.	2.47	2.56	2.70			
To 10 wks. 6 days:— Live weight (lbs)	3.45	3.45	3.19	3.55	3.33	3.07
Lbs food/lb L.W.	2.84	2.92	3.05	2.91	3.08	3.13

as before. As was to be expected the Wheat was consumed with avidity but the feared outbreak of cannibalism did not show up, due I think to the provision of dim lighting. In fact it was interesting to me that even in the low protein group feathering was good throughout and did not on observation appear to be inferior to the others. This trouble might have been forecast you will agree, at such a wide Cal/P ratio. The net Cal/P ratios of the food consumed by the Wheat fed groups during the last three weeks were 56, 61 and 65: 1 on the high, medium and low protein meals respectively. Similar quantities of Wheat were taken by each group rather to my surprise since one might expect the consumption to increase with the protein content of the meal being fed.

Please refer now to graph A. This demonstrates that on the whole a Cal/P ratio of 44: 1 gave almost as satisfactory



growth as the high protein ration but note also that ration No. 3 was inferior only up to the 6th. week and thereafter promoted as rapid growth as the other rations.

In similar vein, from the 8th. week a reduction in the net protein content of the food by the addition of Whole Wheat depressed growth at the two wider ratios but not at the 56: 1 level. Thus it would appear under the conditions of

TABLE 3. COSTS OF FOOD AND GROSS RETURNS

	All meal groups			Meal plus Wheat		
Equal numbers of males and females.	1	2	3	1A	2A	3A
Cost of meal per lb. (pence)	4.75	4.33	4.0	4.75	4.33	4.0
Cost per bird of all food (pence)	45.2	44.5	38.8	44.6	40.6	35.9
Gross return @ 2/3^{d} per lb. L.W.	93.0	93.0	86.1	96.0	89.9	82.9
Margin over food cost per bird	47.8	48.5	47.3	51.4	49.3	47.0
Margin over food cost per lb. L.W.	13.5	14.4	14.8	14.5	14.8	15.3

Note. Average price of wheat was 3.08^{d} per lb. or £ 28—15—0 per ton. Differences in L.W. of 0.14 lbs. significant at P = .01.

this experiment that up to 6 weeks a Cal/P ratio at least as wide as 44:1 supports maximum growth rate and 54:1 would appear satisfactory after 6 weeks. At 8 weeks a ratio as wide as 56: 1 is adequate and at 10 weeks even 65 to 1 appeared to give a similar rate of gain to the higher protein foods. Incidentally, the ratios of 37 and 44: 1 actually depressed growth rate during the final week. This pattern of Calorie: Protein: Age relationship fits in well with expectation.

COMMERCIAL ASPECTS

All this sounds fine but now comes the snag! In every case the wider Cal/P ratio impaired the food conversion efficiency, as may be seen from Table 2. Now this is of considerable economic interest as you will see by referring to Table 3. Here I have shown the food cost structure and returns per bird. You will note with surprise I think that the gross margin over food cost varies only 4½ over all six treatments with the high protein groups leaving the most profit and the low protein the least. A point that should be remembered is that the low protein groups were about ½ lb. lighter than the others and if sold on their own would probably have commanded 1d per lb. less. However the grading results were excellent and the groups appeared indistinguishable to the eye of a professional grader.

I would add at this juncture that the profitability of the supplementary Wheat feed is of course influenced by the price of wheat relative to that of the meal being fed, nevertheless the result is interesting and provides food for thought.

In conclusion I would like to make the following observations:—

1. That the results of the trial using Wheat in large quantities were reasonable, and, had the batch not suffered attacks of Cêacal and Duodenal Coccidiosis (before the addition of the Nicarbazin), would have been even better. The graph shows a kink at about six weeks which represents the period of Coccidiosis attack.
2. That these rations are experimental and not intended to represent the ideal for practical use. Indeed the high protein ration is decidedly unsuitable owing to the wetness of the droppings. It is my impression too that without the Tallow, trouble from pasting up of the beak would be more likely although I have no confirmation of this.
3. The work is continuing and a second trial is nearing completion which in parts repeats the first. In this an attempt is being made to relate growth rate depression on wide Cal/P ratios to protein deficiency per se or to specific amino acid deficiency.

LONG TERM EFFECTS OF FEEDING ANTIBIOTICS*

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We started using antibiotics in this country following the discovery that chicks often grow faster when a small quantity of antibiotic is mixed in the feed. The appeal was obvious to farmers wishing to reduce the risks attached to rearing poultry. There were many questions unanswered and at Reading we asked the question—"Will it be beneficial or harmful to our breeding stock if we rear them on food containing antibiotics?"

With support from the Agricultural Research Council we tried to throw some light on this question by keeping two small flocks of Light Sussex through several generations; one flock having penicillin in the chick mash to 8 weeks of age in each generation, the other flock to have similar management but without any antibiotics. I would make it clear that we were concerned with a low level of supplementation—4 grams to the ton—to give rapid early growth and at no time did we feed penicillin at a high level or after 8 weeks of age.

The flocks were formed in 1952 from a pedigree hatch of chicks divided into two halves which were similar in family relationship. They were reared in field brooders on grass and the penicillin flock were about 10% heavier at 8 weeks than the control lot. After 8 weeks, the chicks were reared together on a normal growers ration. At 20 weeks, the birds were moved into 4 breeding pens with 15 pullets in each; that is, two pens from the penicillin flock and two from the control flock. These were mated to the best Light Sussex cockerels from the same hatch—two that had received penicillin and two that had not. (In actual fact, they were two pairs of brothers).

Eggs were hatched in the spring and the chicks were reared as before. The females of each pen were replaced annually by their pullet progeny and the cock was replaced by a son of the *other* pen of the line.

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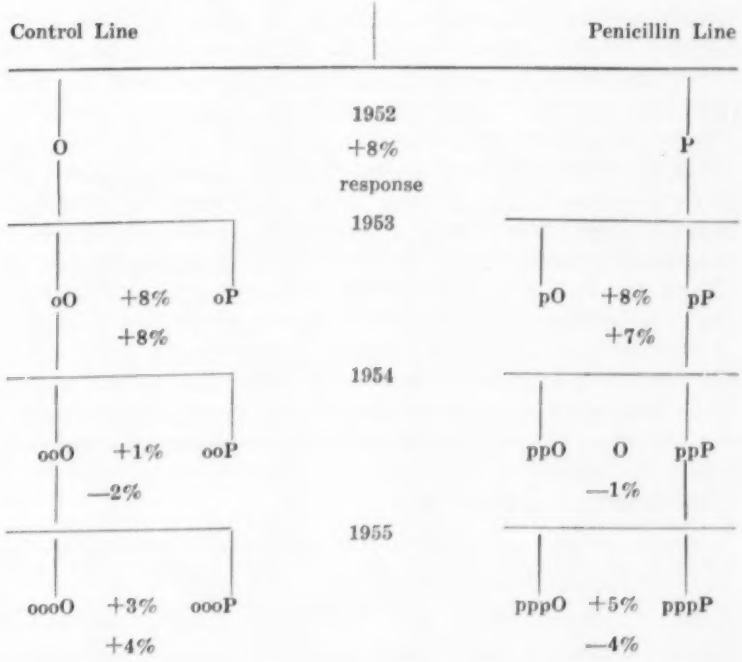
* Presented at the meeting of the United Kingdom Branch of the World's Poultry Science Association, held in London, England, March 29, 1957.

Diagram: Scheme for reproducing each two-pen flock.
Control line
2 pens

	Pen 0_1	Pen 0_2
1952	♀ x ♂ unrelated	♀ x ♂ unrelated
1953	♀ (progeny of 1952 pen 0_1) x ♂ (progeny of pen 0_2)	♀ (progeny of 1952 pen 0_2) x ♂ (progeny of Pen 0_1)
1954	♀ (progeny of 1953 pen 0_1) x ♂ (progeny of 1953 pen 0_2)	♀ (progeny of 1953 pen 0_2) x ♂ (progeny of 1953 pen 0_1)

(Similarly for Penicillin Line)

Diagram: Responsiveness of each generation to penicillin, and mean responses obtained for mixed sexes in two trials.



In this way we do not mate closer relations than cousins or half-cousins. (If we had had only one pen for each line, we would have no alternative to close in-breeding and mating half-brothers and sisters). Actual selection of males from

the available cockerels was based on fitness generally, adequate dam's performance and best weight at 8 weeks old.

The two breeding flocks were reproduced in this way for three generations, until 1955. Each year about one month's eggs were incubated in two hatches and the progeny of each pen were reared, half with penicillin in the diet and half without antibiotic.

Although we finally retained only the *pure* line of control chicks and the pure line of "penicillin" chicks, the other halves gave us a measure of whether or not the generation was responsive to penicillin.

We found, as others have done, that the measured response to penicillin was extremely variable. Sometimes cockerels responded more than pullets: sometimes the reverse: sometimes there was no apparent response at all. The diagram gives in round figures the response in the two hatches for each year, for mixed sexes. You will see that in 1954 penicillin had no effect at all on growth. But in 1955 both folds were significantly heavier by about 4% when penicillin was fed.

There were some outstanding chicks in 1953 in the penicillin line and we wondered if this could be a build-up effect. However by interchanging sires and testing a further hatch, we found that one cockerel in the penicillin pair was throwing these large progeny. This does show up a weakness in design. The effects of genetic inequalities in the two foundation stocks cannot be differentiated completely from effects due to the penicillin. When the experiment ended in 1955 the chicks of the penicillin line were in fact superior in average size at 8 weeks to the control chicks (both with and without penicillin in the ration). This may be a cumulative effect of feeding penicillin, acting perhaps by influencing selection, but may as likely be due to genetic differences arising by chance.

A word about egg production:

Average Egg Production

	O-line	P-line	O_1	P_1		O_2	P_2	
1952-3	197	197	182	198	+	212	196	—
1953-4	180	188	188	182	—	171	193	+
1954-5	174	186	171	205	+	177	167	—

Overall egg production was a little higher in the penicillin line during the final year. However if we look at the pairs of single pens, which are two replications within the ex-

periment, we see that egg production in the last recorded year was *superior* for the penicillin line in *one half* of the experiment, but *worse* than the controls in the *other half*. We cannot therefore say that the apparent overall advantage is a real one due to feeding penicillin.

Percentage Hatchability of Fertile Eggs:

	O_1	P_1	O_2	P_2
1953	68	69	76	79
1954	59	91	84	86
1955	77	86	70	73

As regards hatchability, you will see that the penicillin birds maintained a small advantage throughout the experiment, in both of the replications. One can say that the odds on this result occurring purely by chance are 3 to 1 against. Not very long odds—but it might be worth investigating this difference by further experiment.

To sum up: feeding penicillin in the chick stage to a small group of Light Sussex did *not* show any adverse effects on breeding performance. There were apparent advantages in body weight in the third generation and better egg production and hatchability each year. But we would urge caution in ascribing these advantages to the feeding of penicillin. Growth responses due to feeding penicillin were still seen in the third generation.

Some of you in the audience may have formed opinions on this question of feeding antibiotics to breeding stock. It would be of interest to hear about them.

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Dr. G. F. Heuser
608 Hillside Drive
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AN ACCOUNT OF A SERIOUS INFESTATION WITH GAPEWORMS (*SYNGAMUS TRACHEA*) IN GROWING TURKEYS*

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Gapeworm disease caused by the nematode worm *Syngamus trachea* was very common in turkey and hen chicks during the period between the two great wars but has since played only a minor role in producing mortality in poultry. The disease has been intensively studied by a number of research workers and a great deal is known about the parasite. This report deals with an isolated but interesting case in a turkey flock where the straw yard system of management appeared to influence the intensity of the infection. For the benefit of those of you who may not be familiar with the habits and life-cycle of the gapeworm I propose giving a brief account of its life-history.

LIFE HISTORY

The adult worms, which occur in pairs consisting of a small male permanently attached to a large female, live in the trachea of the turkey, fowl, pheasant, guinea fowl, goose and various wild birds. The eggs discharged by the female worms are coughed up and swallowed by the birds. They pass down the digestive tract and are discharged in the droppings. Within the egg an embryo develops into a larval worm. The larva may hatch out on or after the ninth day and at this stage it is capable of setting up infection if swallowed by another bird. In 1934 Morgan and Clapham discovered that larvae which are first ingested by earthworms are rendered more infective to birds picking up such earthworms. In the same year Clapham discovered that the passage of lavae in earthworms had the effect of enabling strains of *Syngamus trachea* from wild birds to be more readily transmitted to chickens. Taylor in 1938 showed that infective larvae of *Syngamus* could be maintained in earthworms for as long as four and a third years. When infective larvae are ingested by a bird, whether they are enclosed in earthworms or not, they make their way to the lungs by an unknown route; although probably by the blood. The trachea is reached within seven days and the worms mature in 17-20 days. Starlings and other

* Presented at a meeting of the United Kingdom Branch of the World's Poultry Science Association held in London, England, March 29, 1957.

birds are known carriers of the disease.

The outbreak in question occurred in July of 1956 on a farm where about 2,000 Beltsville White and American Mammoth Bronze turkeys were being reared. Groups of about 50 birds were housed in earth bottom straw yards, only part covered at the top by metal sheet. Observation of the birds revealed that a large percentage were showing the typical symptoms of gaping and coughing. Gapeworms were seen in about a quarter of the birds examined. The most severely affected were white turkeys 12-14 weeks of age. Ten deaths had occurred in birds aged 12-14 weeks, older birds were also affected but not so severely. Affected birds failed to feed and their weight gain was considerably reduced; their feeding improved after about a month but thereafter failed to grow as well as groups less severely affected with *Syngamus*.

Starlings may have been the source of infection. Early in the year the top of the pens were frequented by starlings which were known to have passed quantities of droppings on to the litter. The outbreak began at one end of the farm and spread to the neighboring pens. The weather at the time of visiting these premises was warm and sunny and had followed a very wet season thus providing ideal conditions for the development of gapeworm eggs passed in the droppings. Examination of the litter showed that the surface was in reasonable condition but below the surface and throughout its depths the litter was very damp. Enormous numbers of earthworms of the species *Eisenia foetida* were found below the surface in the litter, these are red in colour and are known as "Brandlings." They are frequently found in manure pits. A collection of these worms was removed to the laboratory for examination. Macerated worms were fed to 18, 1 week old White Leghorn chickens which became infected with *Syngamus*. After 20 days, two chicks had died and the remainder showed symptoms of gapeworm infection. The birds were killed and examined. Sixty two pairs of adult worms were obtained from the 18 birds, each of which carried on an average from 1-8 pairs of worms in the trachea.

Litter and faeces collected from the infected pens on the farm were found to contain *Syngamus* eggs.

Great difficulties were encountered in treating the infected birds and eliminating the earthworms from the pens. Barium Antimonyl Tartrate is considered highly effective in the treatment of young birds. The poults are placed in a cardboard box with sufficient drug to produce 1 oz. of drug in 8 cu. ft. air and the poults left in contact for a maximum of

15 minutes. In this way the drug is inhaled and the worms killed by direct contact. The treatment of 12-14 week-old turkeys was tried by enclosing them in a small wooden hut. The Barium Antimonyl Tartrate was blown into the hut with bellows. The treatment had little or no effect since the method of administering the barium antimonyl tartrate was unusual and the fact that the large cubic capacity of the hut was such that a therapeutical concentration was probably not obtained. Treatment of the earth floor of the pens with "Mowrah" meal applied at 6 oz. per sq. yard earth appeared to be highly effective in destroying the earthworms. However, six months later some earthworms were recovered but their numbers were small when compared with other pens not so treated. These earthworms were fed to 3 week old W. L. chickens. They were killed 12 days later and *Syngamus* worms were recovered from the trachea. Litter from the previously affected pens was collected at the same time and examined, *Syngamus* eggs were found in these samples.

The fact that infection with gapeworms in these turkeys reached disease proportions was largely due to the management of the litter. The infection would have been markedly reduced if the earthworm population had been controlled. Concrete floors to the pens would have prevented the migration of the earthworms into the straw. The pens were not adequately covered and in consequence the litter was damp near the surface and saturated at the base. *Eisenia foetida*, the "Brandling" worm would have been discouraged from migrating far into the litter if fresh straw had been added at frequent intervals. *Eisenia* earthworms reproduce rapidly in locations where a plentiful supply of organic material is available, contrasting with the common earthworm, which is much slower in its reproduction. *Eisenia*, therefore, is a highly suitable transport host for *Syngamus* kept under the straw yard system. In our efforts to provide an economic and practical form of husbandry for turkeys in this country new problems of disease may arise. Gape-worm disease was a problem many years ago and is now comparatively rare in domestic poultry. In this isolated case it caused disease of considerable importance when a prolific earthworm transport host took advantage of the conditions provided by this straw yard system.

REFERENCES

Clapham, P. A. (1934) Proc. Roy. Soc. B. *115*, 18.
Morgan, D. O. and Clapham, P. A. (1934) J. Helminth. *12*, 63.
Taylor, E. L. (1938) Vet. J. *94*, 327.

INORGANIC IODINE IS NOT THE FACTOR IN FISH MEAL WHICH DEPRESSES HATCHABILITY*

A. MARSDEN, R. C. JENNINGS, AND R. S. MARTIN
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It is standard practice in Great Britain for the rations of breeding hens to be supplemented with animal protein, the chief source of which is white fish meal. Since this substance has been incorporated in rations for many years it was rather surprising when Black (1953) and Black et al. (1954) reported that fish meal depresses the hatchability of fertile eggs. This result has, however, been confirmed by Shaw (1955) and Coles (1956), and has been repeated on several occasions at Reading.

Black et al., opened all eggs which failed to hatch and found the decrease in hatchability to be accounted for by increased embryo mortality during the last 3 days of incubation. Coles agrees with this, reporting a higher mortality peak on the nineteenth day. By feeding eleven per cent fish meal to breeding hens, Black et al. were able to show a reduction in the vitamin A, riboflavin and pigment contents of the eggs irrespective of whether the birds had access to grass range or dried yeast and cod liver oil. This result in terms of vitamin A was repeated by Coles who noted also that the vitamin B_{12} content of his fish meal ration decreased over a 16 week period. Ten per cent fish meal did not appear to cause a reduction in the riboflavin content of the ration.

Black et al. reported that full term dead in shell chicks produced from the fish meal ration showed a higher incidence of pale livers and urates on the pericardium. Otherwise the chicks appeared normal. Coles does not comment on the condition of the chicks but reports higher mortality during the first six weeks among chicks which hatch from the fish meal ration. He concludes that this is probably due to bacterial infection of the yolk sac by faecal type coliforms and enterococci.

Since 1953, work done at Reading (to be reported elsewhere) suggests that neither simple deficiencies of the more common vitamins nor oxidation of fat soluble vitamins is the cause of the depression.

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* Presented at the meeting of the United Kingdom, The World's Poultry Science Association held in London, England, March 29, 1957.

It happened that chicks from the experimental pens at Reading were used in work on thyroid stimulating hormone at the Post Graduate School of Medicine, London, where it was found that the thyroids of chicks from parents fed 11% fish meal were unable to assimilate normal quantities of radioactive iodine in a 24 hour period. This suggested a new approach because of the extremely high iodine content of fish meal and the important role of iodine-containing hormones in physiology and reproduction.

The early work on iodine deals with it mainly as an inorganic substance and is adequately reviewed by Branion (1938). Since that time most of the work reported is concerned with iodine as constituent of endocrine products. Wilgus et al. (1948) did, however, report that dietary levels of iodine in excess of 23 mg/lb had a detrimental effect on hatchability and chick quality.

Wheeler and Hoffman (1948) fed thyroprotein to breeding hens and found that though the hens themselves became hyperthyroid, the chicks produced were hypothyroid having enlarged thyroids and a lower metabolic rate. This they were entirely unable to explain but suspected that free inorganic iodine in the iodocasein used might be responsible. When, however, they used iodocasein which contained no free iodine the same result was obtained. (Wheeler and Hoffman, 1950). Wheeler and Houston (1955) showed that potassium iodide has a similar effect to thyroprotein. They also reported that di-iodotyrosine (a precursor of thyroxine) causes a decrease in thyroid size when fed direct to chicks but when fed to dams it causes an increased development of the thyroid in hatched chicks. They therefore conclude that changes in the chick thyroid are due to the passage into the egg of some non-thyroactive substance which decreases metabolic rate.

McCartney and Schaffner (1949), fed iodocasein to laying hens and found that this increased the incubation period of their eggs by over twelve hours. This work agreed with that of Wheeler and Hoffman (1949), when they demonstrated that injection of potassium iodide into eggs of sixteen days incubation caused hypothyroid chicks which took longer to hatch with a slower closure of the umbilicus. This factor may be important as a means of bacterial entry in the work of Coles, particularly when the chick has pipped the shell before its death.

Booker and Sturkie (1949), confirmed the results of Wheeler and Hoffmann. By injecting thyroprotein into eggs

during the early part of incubation (before a chick thyroid was produced) a decrease in chick thyroid weight was caused. This shows that the hypothyroid chicks produced from hyperthyroid hens are not caused by the direct passage of thyroprotein into the egg.

Other evidence is produced by Arscott et al. (1954) who, using a very simple oat ration supplemented with vitamins, obtained a marked reduction in hatchability by feeding thyroprotein. A similar result occurs in the report of Savage et al. (1952), who fed thyroprotein in conjunction with a ration containing 10% fish meal and 5% dried skim milk. The animal protein caused a considerable increase in hatchability over an all vegetable ration supplemented with potassium iodide. When the animal protein ration was supplemented with thyroprotein a marked drop in hatchability occurred.

Hyperthyroid birds have a much higher metabolic rate and consequently have higher requirements for many vitamins. Only one example will be quoted here. Wheeler and Perkinson (1949), showed that chicks in a hyperthyroid condition had a greater requirement for vitamin E. Requirements of Vitamin A, thiamin (B_1), pyridoxine (B_6), niacin, pantothenic acid, and vitamin B_{12} are also known to be higher in cases of hyperthyroidism.

The only direct evidence to date that fish meal affects the chick thyroid is that of Keeling et al. (1955), who obtained a decrease in thyroid size by feeding fish meal to chicks.

Since fish meal does not appear to depress hatchability on all occasions (Gordon et al. 1954, and others), it might be that in these cases incubation conditions have been more favourable to hypothyroid embryos or that the ration has been better supplemented with those factors important in the ration of hyperthyroid breeding hens.

METHODS AND MATERIALS

An experiment was commenced on April 24th 1956 to investigate the effects on hatchability of fertile eggs of feeding various levels of iodine and a fish meal supplement of known iodine content.

The basal ration used was that given by Black et al. (1954) with riboflavin and manganese sulphate added. The formula was as follows: ground maize 25%; ground oats 20%; ground wheat 20%; middlings 25%; bran 10%; riboflavin 4.5 gms per ton; manganese sulphate 4 oz per ton.

The experimental rations are as follows:—

1. 200 lbs base + 1 lb common salt
2. 200 lbs base + 1 lb common salt + 25 lbs fish meal
3. 200 lbs base + 6/7 lb common salt + 1/7 lb iodized salt
4. 200 lbs base + 3/7 lb common salt + 4/7 lb iodized salt
5. 200 lbs base + + 1 lb iodized salt

The iodized salt contained 0.21 gms KI per lb. The iodine content of the cereal base was .08 p.p.m. and that of the fish meal 9.2 p.p.m. Rations 3, 4 and 5 contain the amount of iodine which would have been added in Ration 2 had fish meal contained 2.0, 9.0 and 16.0 p.p.m.

Crude protein, crude fibre, and iodine levels are shown in table 1.

TABLE I
Composition of Rations

Ration	*Crude Protein %*	*Crude Fibre %*	*Iodine p.p.m.*
1	11.6	32	0.08
2	17.5	28	1.09
3	11.6	32	0.29
4	11.6	32	1.07
5	11.6	32	1.84

Each ration was fed to two pens. The experiment lasted 12 weeks though weeks 1, 2, 7 and 8 were discarded as change over periods. The birds in block 1 (pens 13-17) received the same treatment throughout but those in block 2 (pens (18-22) were changed after 6 weeks. The lay out of the experiment was as follows:—

Ration	BLOCK 1 *Weeks 1-12*	BLOCK 2 *Weeks 1-6*	*Weeks 7-12*
1	Pen 15	21	22
2	Pen 17	22	21
3	Pen 13	20	18
4	Pen 16	19	20
5	Pen 14	18	19

Each pen contained a fair cross section of the pure Light Sussex females kept on the farm the actual numbers varying from 31 to 37. There was an age gradient through the flock —the oldest in Pen 13 were hatched on February 22nd 1955 and the youngest in Pen 22 were hatched on April 27th 1955. Each pen was mated to three Rhode Island Red cockerels which were moved at weekly intervals to the next pen within

a block to mask any genetic differences there may have been.

The birds were housed in colony houses with trap nests, each house being moved whenever necessary within a grass pen of 600 sq. yards. Mash was the only food fed, being available at all times, though a portion of the ration was fed in a moist condition each morning. Calcium and flint grit were available ad libitum.

The birds were trapnested and all eggs recorded against the hen. All eggs except those which were cracked or required for analysis, were weighed and set at weekly intervals in a Stephens Preheated Cabinet Incubator. After 18 days all eggs were candled and separately weighed to each hen as fertiles or "clears". This took place in a warm room and took some ten minutes for each batch of eggs. They were then placed in a Stephens Preheated Still Air Hatcher. On the 21st day half the hatch (determined by taking eggs and chicks from alternate hens) was taken and dried off in a standard Stephens Incubator. On the 22nd day this hatch was removed from the incubator and the chicks counted. As soon as these had been removed the second half of the hatch was transferred to the standard incubator to be taken off on the 23rd day. The eggs from each hen alternated from week to week between a 22nd and a 23rd day incubation period. All chicks were sexed by down colour and worthless chicks were recorded. All eggs which failed to hatch were opened and recorded as infertile or the sex, age of death and any abnormalities noted.

Chicks of both sexes from Hatch No. 6B (i.e. the 6th hatch on the 23rd day) were reared to 27 days and body weights recorded. 20 chicks from each ration in Hatch 6A were injected subcutaneously with 0.25 m.l. of radio-active iodine. After exactly 24 hours the radio-active emanations from the chick thyroids were recorded as a measure of the radio-active iodine assimilated by the thyroid.

The adult females were weighed individually at the start of the experiment and again 6 and 12 weeks later to measure any body weight changes.

Several eggs were taken from Block 1 for Vitamin B_{12} analysis, and several eggs and embryo's were inspected for the presence of bacterial infection.

RESULTS AND DISCUSSION

Egg Production

Average egg production for the two experimental periods is given in table 2.

TABLE 2. PERCENTAGE EGG PRODUCTION ON A HEN WEEK BASIS

	Block 1		*Block 2*		*Mean*
Weeks	*3-6*	*9-12*	*3-6*	*9-12*	
Ration					
1	54.5	48.1	49.0	41.8	48.3
2	53.8	50.2	59.1	56.5	55.0
3	55.3	44.0	56.6	55.1	53.0
4	55.8	53.0	46.0	52.3	51.8
5	58.7	50.0	64.3	51.0	55.8

No marked trends can be seen in these figures other than the possible depression in production caused by the control ration. This occurred at a time of year when production would normally fall and is of doubtful significance. Average production was rather low but the flock was completely unculled and the experiment was carried out late in the season.

Food Consumption

Average food consumption on a hen week basis was fairly uniform with an overall upward trend. Since food consumption is affected by so many other factors it is impossible to apportion such variations as occur to the treatments involved.

Body Weight

The average body weight for each group of birds at the beginning of the experiment is given in table 3, together with the changes which occurred during the two six-week feeding periods.

Had the fish meal contained significant amounts of a thyroactive substance weight losses would have been expected. The evidence shows that these did not occur. If anything, birds on rations 3, 4 and 5 lost most weight but these differences may not have been entirely due to the rations fed.

Fertility

Overall fertility fell throughout the experiment, as is normal at that time of year, from 74.4% in week 1 to 62.5% in week 12. Variations from week to week are so great that they mask any real difference which might have been due to treatment.

Egg Weight Losses

The differences in average egg weight are so small compared with the range in average weights of individual birds'

TABLE 3. AVERAGE INITIAL BODY WEIGHTS OF SURVIVING BIRDS

with changes (in grams)

Ration		*Initial Weight*	*Gains: Weeks 0-6*	*Gains: Weeks 6-12*
Block 1:	1	2757	—79	+33
	2	2788	—30	—4
	3	2855	—153	—21
	4	2838	—130	0
	5	2815	—147	—60
Block 2:	1	2613	—59	—91
	2	2487	+62	+88
	3	2705	—116	+1
	4	2623	—171	—14
	5	2698	—186	+11

eggs that it is not possible to attribute them to ration differences. Changes in egg weight are small and not appreciably affected by the treatments.

Hatchability of Fertile Eggs

Tables 4 and 5 show the hatchability of fertile eggs on each treatment. In table 4 results are given for incubation periods of 22 and 23 days in each 6 week period.

TABLE 4

Per Cent Hatchability of Fertile Eggs According to Length of Incubation Period

Block 1	*Period 1*			*Period 2*		
Ration	*22 days*	*23 days*	*Mean*	*22 days*	*23 days*	*Mean*
1	78	86	81.7	73	72	72.2
2	74	77	75.9	57	76	66.8
3	76	80	78.2	76	73	74.2
4	85	86	85.6	78	81	79.3
5	75	84	79.5	75	67	71.0
Block 2						
1	76	85	80.2	75	81	78.0
2	80	81	80.6	60	63	61.5
3	93	89	90.9	70	81	75.5
4	88	84	85.6	84	80	82.1
5	85	83	83.7	80	81	80.1

TABLE 5

Summary of Hatchability of Fertile Eggs for the Whole Experiment

Ration	*Fertile Eggs Set*	*Total Chicks Produced*	*Hatchability %*
1	1131	890	78.69
2	1282	916	71.45
3	1312	1061	80.87
4	1426	1186	83.17
5	1406	1117	79.45

In Block 1 hatchability was lowest on the fish meal ration. This depression was lower than reported by Black et al. (1954) and Coles (1956). In Block 2 there was no depression caused by adding fish meal to the cereal base during the first period. When, however, the rations were interchanged in the second period the fish meal depression appeared showing that the original failure to show the depression was due to variability in the birds themselves. The figures in table 5 for hatchability leave little doubt that for the experiment as a whole fish meal did depress hatchability. Leaving eggs in the incubator for another 24 hours merely increases the total hatch by some 2%. As in previous work the difference in embryo mortality occurred after the 18th day of incubation. There is no appreciable difference between the hatchability rate of the eggs from hens fed potassuim iodide. It is not certain whether the improved level of hatchability obtained with the iodine supplemented diets was due to the ration or due to chance.

Chick Growth

The average 27 day old body weights of chicks from hatch 6 B are shown in Table 6.

TABLE 6

Average 27-day Chick Weights (in grams)

Ration	*Pullets*	*Cockerels*
1	245.5	289.9
2	250.5	269.7
3	239.5	299.4
4	255.5	278.8
5	248.5	287.6

From these figures it would seem that neither fish meal nor potassuim iodide has any detrimental effect on the growth of chicks.

Uptake of Iodine by Chick Thyroids

Table 7 shows the average "in vivo" counts of radio-activity as measured by a geiger-counter 24 hours after 0.25 m.l. of a solution labelled with I^{131} had been injected sub-cutaneously. The radio-active concentration of the iodine solution was 71.9 μ curies/ml.

TABLE 7

"In Vivo" counts of radioactivity 24 hours after injection of I^{131}—labelled solution

Ration	*"In Vivo" Counts*
1	4,799.7
2	2,674.9
3	4,445.5
3	4,445.5
4	2,604.1
5	2,554.7

There is no difference between counts for rations 1 and 3 or for rations 2, 4 and 5. Rations 1 and 3 vary from rations 2, 4 and 5 by a margin which is very highly significant ($P = .001$). These results amply confirm the data obtained by chance in 1953 and indicate that fish meal when fed to hens reduces the uptake of iodine by the chick thyroid. This can mean either that the thyroid is already saturated with iodine or that its power to assimilate iodine is subnormal. Whichever is the case it shows that the iodine content of fish meal has an effect on the activity of the chick thyroid. Whether the effect caused by fish meal is due to iodine in an organic or inorganic state is still not clear.

Vitamin B_{12} Content of Eggs

Table 8 shows the vitamin B_{12} analysis of pooled yolk samples. These values are lower than the normal range (0.5-1.0μ g/yolk) and may be due to the extreme frothing which occurred in all samples. The most interesting point is that the fish meal ration (2) gave the lowest vitamin B_{12} content in the egg, even though the vitamin B_{12} content of that ration

TABLE 8

Vitamin B_{12} Content of Egg Yolks

Ration	*Vitamin B_{12} g/yolk*
1	0.33
2	0.32
3	0.46
4	0.49
5	0.38

must have been higher than the others. Since the evidence is from a pooled sample it is not possible to attribute much significance to the actual figures. It would appear that inorganic iodine does not depress the vitamin B_{12} content of egg yolks.

BACTERIAL EXAMINATION

Three full term embryos from each of rations 1 and 2 were examined for bacteria. In the case of ration 1 no significant organisms were isolated. Embryos from ration 2 all contained large numbers of coliforms. Bacillus cereus was found in the yolk sac and heart blood of these three embryos. Unfortunately the three embryo's from the fish meal ration (2) had already pipped the shell before death occurred whereas those from the cereal ration (1) had not. This may have been responsible for bacteria gaining entry to one sample and not the other. Rapid multiplication of bacteria would be expected in a dead embryo subjected to the high temperature and humidity found in incubators. Whether the umbilicus was slow to close as in the report of Wheeler and Hoffmann (1949) was not ascertained but it was not unusual to find a large proportion of the embryos dying at the stage when the yolk sac was being absorbed.

A number of eggs and developing embryos were examined for bacteria and no significant levels of infection were found. A further sample of dead in shell were examined after removal from the shell. These showed quite high bacterial counts mainly of coliforms. It would therefore appear that the bacteria gain entry mainly after the pipping stage. Infection would therefore appear to be only a secondary cause of death.

CONCLUSIONS

The inclusion of potassium iodide in the ration of breeding hens does not appear to affect egg production or hatchability in the same way as white fish meal. As far as can be ascertained from the data produced iodine at levels of 0.29-

1.84 p.p.m., is in no way detrimental to reproduction in the fowl. These levels do however affect the thyroid of the day old chick produced from such rations in a way similar to fish meal (iodine content 9.2 p.p.m.). If the iodine content of fish meal is responsible for the lower hatchability it must be present in some other form which merits further study. The report of Keeling et al. (1955) that fish meal affects the size of the chick thyroid is of consequence since it is of importance to know to what extent a common foodstuff like fish meal affects production and reproduction.

SUMMARY

An experiment was designed to test the hypothesis that iodine is the factor responsible for the depression in hatchability of fertile eggs which follows the feeding of a white fish meal to breeding hens. Results indicate that iodine (as potassium iodide) does not depress hatchability, nor does it appear to cause any gross abnormalities in the chicks. The ability of the chick thyroid to assimulate radio-active iodine is reduced by feeding potassium iodide or white fish meal to its maternal parent.

ACKNOWLEDGMENTS

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REFERENCES

Arscott, G. H., Sweet, G. B. and Combs, G. F. (1954) Effect of Iodinated Casein in a Simplified Oat Diet on Hatchability of Chicken Eggs. Poultry Science 33: 1283-1286.

Black, D. J. G. (1953) Reading's Experimental work on Hatchability of eggs from ranged stock. Poultry Field 6 No. 11.

Black, D. J. G., Jennings, R. C., Morris, T. R. and J. A. Palgrave, (1953). A Depressant Effect of a White Fish Meal on Hatchability. Proceedings of the 10th World's Poultry Congress and Exposition.

Booker, E. E. and Sturkie, P. D. (1949) The Effect of Thyroxine and Iodinated Casein in the Development of the Chick Thyroid. Poultry Science 28: 147-148.

Branion, H. D. (1938) Minerals in Poultry Nutrition. Scientific Agriculture, 18: 5.

Coles, R. (1956) Observations on the Occasional Depressing Influence of Fish Meal on the Hatchability of Hens Eggs. Journal of Agricultural Science, 47: 354-362.

Gordon, R. F., Chubb, L. G., and Stacey, C. G. (1954) Vitamin B_{12} and Penicillin Supplements in Poultry Nutrition. Vet. Record 66: 71-74.

Keeling, A. D., Hill, C. H., Garren, H. W., and Kelly, J. W. (1955) The Effect of Chlortetracycline and Fish Meal on the Growth and Thyroids of Chickens. Poultry Science 34: 1453-1454.
McCartney, M. G., and Shaffner, C. S. (1949) Chick Thyroid Size and Incubation Period as Influenced by Thyroxine, Thiouracil and Thyroprotein. Poultry Science 28: 223-228.
Shaw, R. B., (1955) Protein Levels in Poultry Feeding. University of Nottingham, Annual Poultry Conference.
Savage, J. E., Turner, C. W. Kempster, H. L., and Hogan, A. G. (1952) The Effects of Vitamin B_{12} and Thyroprotein on Egg Production, Egg Weight, Shell Quality and Hatchability. Poultry Science 31: 22-31.
Wheeler, R. S., and Hoffmann, E. (1948) Goitrous chicks from Thyroprotein fed hens. Endocrinology 42: 326-329.
Wheeler, R. S., and Hoffman, E. (1949) Goitrogenic Action of Iodide and the Etiology of Goitre in Chicks from Thyroprotein-Fed Hens. Proc. Soc. Exp. Biol. and Med. 72: 250.
Wheeler, R. S., and Hoffmann, E. (1950) The Etiology of Goiter in Chicks from Thyroprotein fed Hens: Negative Role of Inorganic Iodide. Poultry Science 29: 306-307.
Wheeler, R. S., and Houston, R. M. (1955) Antithyroidal Influence of Di-iodotyrosine. Poultry Science (1955) 34: 1227 (Abstract).
Wheeler, R. S., and Perkinson, J. D. (1949) Influence of Induced Hypo- and Hyperthyroidism on Vitamin E Requirement of Chicks. Am. Journal of Physiology 159: 287-90.
Wilgus, H. S., Gassner, F. X., Patton, A. R., and Harshfield, G. S. (1948) The Iodine Requirements of Chickens. Poultry Science 27: 686.

A LARGE-SCALE ITALIAN BROILER PLANT

Hold your breath and visit Italy about three or four years from now to see if the broiler plant still exists that figuratively speaking grew faster than the broilers grew while the broiler plant was being developed.

About 30 miles south of Rome, Mr. Armando Zaccardi, a retired business man, started building his broiler plant which Mr. Paul Findlen First Assistant Agricultural Attache, American Embassy, Rome, and I visited on December 6, 1956.

One of the first operations involved digging 19 wells, each 150 feet deep. At the time we were there, there were 140 employees. The incubators, made in Italy, have a hatching capacity of 250,000 eggs. There were 15,000 breeding birds to produce the hatching eggs. There were 80 brooder houses, each 20 feet by 160 feet, all equipped with automatic feeders. Three huge refrigerator trucks are used to deliver the broilers as far north as Manila. I hope that the venture succeeds.

(Morley A. Jull, U. S. O. M., American Embassy, Athens, Greece)

THE APPLICATION OF "FLASH LIGHTING" TO EGG PRODUCTION ON THE DEEP LITTER SYSTEM*

P. MATTHEWS

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At the World's Poultry Science Congress, Paris 1951, Professor W. A. Weber presented a paper on "flash" lighting relative to the stimulation of egg production.

The principle of "flash" lighting consists in the use of high wattage lamps for very short ("flash") periods, a method which has proved as efficacious as the use of electric light for several hours.

Professor Weber's experimental work was carried out during the period 1947 to 1951 at the Swiss Aviculture School of Zollikofen. In his first experiments the 6 hens used were given one 5 second flash, a 40-watt continuous light being used for the control birds from 4 a.m. - 8 a.m.

In further experiments, using 50 W.L. pullets, the flash was increased to two 20 second flashes at 4 a.m. and 4.45 a.m. The control light on this occasion was increased to a 75 watt from 4 a.m. The flash lighting bulb was situated 1.2 metres from the birds, later increased to 2.4 metres (3′ 10″ and 7′ 9″ respectively).

FLASH LIGHTING EXPERIMENTS 1952-1957

Initial trials following Professor Weber's work were carried out at Stoke Mandeville early in 1952, for which the following equipment, costing £25, was installed.

	Price
G.E.C. Relay.	
S.P. Mercury relay, 250 volts, 15 amps.	
Catalogue No: X8010, Serial No: 7679C.	£3. 11. 6d.
Venner Time Switch (24 hour setting)	£5. 16. 0d.
Venner Time Switch	
1 hour setting (controlled down to 20 seconds).	
Type MTZM, 1 amp. No. 4604, Volts 200-250.	£9. 15. 3d.
E. S. Goliath Lamp Holders.	7. 11d. each
1500 watt bulbs.	£1. 5. 0d. each
Wiring for installation.	3. 3½d. per yd.

In the first small scale experiment we tried the effect of two 20 second flashes at 4 and 5 a.m., against the use of 75 watt lamps lit continuously for four hours, but as far as egg production results were concerned the flash lighting appeared slightly inferior.

Observations on the birds at night time showed that they did not leave their perches and, therefore, they were unable to

*Presented at the meeting of the United Kingdom Branch of the World's Poultry Science Association held in London, England, March 29, 1957.

consume any extra feed. In practice we overcame this by giving an afternoon feed of 1 oz. of layers pellets in the food troughs.

We repeated this work the following winter using Gold-Link Pullets housed in 8 ft. x 6 ft. cabins, increasing the number of flashes to four.

Up to the end of the first 28 weeks (Feb. 1953) the results were as follows:—

Group	*Total Eggs per bird*	*Gross Profit*
Flash Lighting (1500 watts for 20 seconds at 3, 4, 5 and 6 a.m.	116	£1. 4. 10d.
75 watt lamps (4 hours continuously 10 p.m.-2 a.m.,	112	£1. 4. 0d.
Control (No artificial lighting)	105	£1. 2. 3d.

These experiments were all carried out in small intensive houses (one lamp per house) and as they appeared successful we therefore decided to transfer the flash lighting equipment to a larger deep litter house (35 ft. x 17 ft.) holding 150 Hybrid pullets the following autumn. Two 1500 watt flash bulbs were installed—one immediately over the perches 4 ft. above the birds' heads, the second lamp being 6 ft. away nearer to the food trough (automatic).

The pullets were housed on September 12th, the first flash lighting being given immediately, with others at monthly intervals; four flashes being given by the 14th November. These were continued throughout the winter until April when they were then reduced by one flash at fortnightly intervals. Production reached 70% just after four flashes had been introduced and continued to rise to 75% during the Feb/March period.

These birds were carried on for a second years' production, but this time we introduced two flashes straight away on the 18th September, four flashes being given by the 2nd October. Following this, production rose rapidly to 70%. The flashes were again discontinued at fortnightly intervals commencing in April.

At one stage a decrease in egg production occurred without obvious cause, until it was realised that in demonstrating the equipment to various parties of visitors daily we were probably over stimulating the birds. We, therefore, stopped

this practice and installed a separate unit for demonstration purposes at a site where the birds were not exposed to the rays, and about three weeks later production had returned to normal.

Our latest trial, again using Hybrids, commenced on the 30th August, 1956. One flash was introduced on the first day with others at monthly intervals, four flashes being given by the 14th November, and by this time egg production had reached 75%.

Production was not improved by increasing the "feeds" from three to four. Ten days later we decided to remove the bulb situated furthest away from the birds and during the succeeding three week period production fell away, settling down at 64%, a drop of 11%. On the 13th January the second bulb was re-installed and production gradually rose again, but not to quite the same level as before.

SUMMARY AND CONCLUSIONS

1. Flash lighting using 1500-watt bulbs appears to be as satisfactory as continuous night lighting for stimulating pullets or hens housed intensively for winter egg production. One 1500-watt lamp per 300 sq. ft. is adequate, but where two or more lamps are installed, they should be sited over the perches so as to give the full force of their rays direct to all the birds at once.

2. The cost for a small deep litter unit of 150 pullets is approximately £25, but the same series of time switches would be suitable of course for a much larger number of lamps.

3. As the birds do not leave the perches, supplementary feeding is necessary during the day time, for which pellets are ideal.

4. Three flashes from two 1500-watt bulbs switched on for 20 seconds at hourly intervals (3, 4 and 5 a.m.) gives the optimum response. Additional exposures do not increase egg production, in fact a much greater number decreases egg production. It has not been determined whether the same flash-lighting system works equally well at times of the night other than in the early morning—4.0 to 6.0 a.m.

5. Although the system is costly to install, it is very cheap to run, costing only 1½d. per month for 150 pullets. The lamps are very sturdy and we have not had to change one, even after five years' use.

6. It is unlikely that flash lighting could be adapted to hen batteries, unless a large series of lamps was installed, in view of the difficulty in getting the light to reach the bird's head for pituitary stimulation purposes.

HIGH LEVEL ANTIBIOTIC SUPPLEMENTATION OF POULTRY FOODS*

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The use of supplements containing so-called nutritional levels of antibiotics in poultry foods have become fairly general in this country only in the case of chick foods. In America the so-called high level supplementation of poultry foods is a common practice. While the level of antibiotic on a nutritional level may vary from 2 to 10 grammes per ton of food, these higher levels may range over 25, 50, 100 or even 200 grammes per ton.

In order to understand the implications of high level feeding, we must remember that antibiotics were first used as supplements following the investigations into the value of aureomycin fermentation by-products which were known to contain appreciable amounts of vitamin B_{12} but it soon became evident that the benefits following their use were largely because of the residual antibiotic content of the material. Because of this mode of introduction the levels of antibiotics involved were obviously small.

Early investigations showed that the feeding of these so-called low levels of aureomycin enabled chicks to grow more quickly on the same or even less food than controls. It was found that the greatest results occurred in the young chick during the first few weeks of life, and then the rate of gain became reduced as the birds grew older and bigger and the improved growth rate disappeared even though the low level of antibiotic continued to be fed. It was shown that when antibiotics were included later on in life, when the birds were two or three months old then the response to the antibiotic was often insignificant.

An explanation for this, which is now widely accepted is that the food intake per unit of body weight of the chick declines rapidly in birds from day old to 12 weeks, and the decline in response continues until maturity at about 12 to 20 weeks. To illustrate this, the feed intake of the chick, gramme of food per gramme of body weight per day falls from 0.21 at up to 2 weeks of age to 0.11 in birds of 6 to 8 weeks, and 0.07 in birds aged 10 to 12 weeks. This means that at 10 grammes per ton the intake of antibiotic which amounts to 2.3 milligrams per kilogram of body weight per

* Presented at a meeting of the United Kingdom Branch of the World's Poultry Science Association held in London, England, March 29, 1957.

day has fallen to 1.2, or almost half, in birds aged 6 to 8 weeks, and to 0.8 in birds of 10 to 12 weeks. Obviously then, if two to three units of antibiotic per unit of body weight produce the growth effects when the chick is 2 weeks old, then it cannot be expected that only 0.8 would do the job when the bird is bigger.

Detectable levels of the antibiotic in blood serum were found when the birds were a week old when 10 grammes per ton fed, but not when the birds were 14 days old. Whereas, at 50 grammes per ton detectable levels were still obtained when the birds were 14 weeks old, and of course the same holds true for higher levels. We must remember from this that at the same time as the intake of antibiotic is falling, as the chick gets older, the quantitative bacterial contamination of the environment is increasing, so that the bird is faced with a constantly reducing means of combating infection while the infection itself is constantly increasing in quality. For this reason it would be sensible in broiler premises especially to feed a nutritional rate of antibiotic for the first 6 weeks, and to increase this quantity for example by doubling it for the last 6 weeks, say 25 grammes per ton, or to feed at the 25 gramme level right through from the day old to killing.

So far as the older bird is concerned, the times of stress that the bird is likely to face are at the time of increased bacterial infection when the pullets are put on to deep litter, possibly from free range, or in pullets in later stages of production when the litter has become heavily contaminated with bacteria.

In the first instance, and this is especially true if the litter has been used previously, the young birds will receive a check, which can be overcome by the feeding of a level of say 25 grammes aureomycin hydrochloride per ton of food. In the second instance, where there has been a gradual build up of bacteria in the litter, the birds become "stale", appetite drops and production follows suit. This can be greatly helped by a like level for a period of two to three weeks.

In America there is a tendency now to feed a high level of antibiotics continuously presumably because over the years of intensive poultry keeping a very large bacterial population exists. We have not yet arrived at that position in this country and consequently lower levels may suffice.

In the diseases of intensive poultry keeping, such as pullet disease, high level (that is higher than the chick feeding level and yet not so high as the American level) of 50 to 100 grammes per ton will often produce spectacular results. Flocks

of birds showing the symptoms of pullet disease will, in a few days of feeding 100 grammes aureomycin hydrochloride per ton of food, show improved appetite and the birds' appearance will change for the better and egg production begin to look up, and within 10 days may have returned to almost normal. I know that it has often been said that these outbreaks of pullet disease will respond if no treatment is given, but this is generally a very lengthy and uncertain business with continued economic loss, whereas in pullet disease treated early with aureomycin the response is often almost instantaneous and where controls have been kept and no antibiotic fed those birds have continued to decline in egg production and health.

In outbreaks of coryza levels of aureomycin hydrochloride in the region of 200 grammes per ton fed for ten days or a fortnight have often overcome the epidemic and it is customary on certain farms now to feed this high level to birds at the time that a change it made from brooders and where often an outbreak of coryza is experienced.

To reiterate then, higher levels than the normal low chick level are often beneficial if fed to chicks after six weeks of age, in broilers, and levels of 25 grammes per ton are helpful to birds placed on deep litter for the first time, or in the later stages of production on deep litter, while higher levels than this are beneficial in the control of pullet disease, and a level of 200 grammes per ton will often control epidemics of coryza or chronic respiratory disease.

It might be reasonable to ask when a continuous high level of aureomycin should be used, and a good guide is the relation between the final feed conversion expressed as pound of food per pound of body weight gained. This can be used as a rough and ready means of determining the advisability of using high levels. In America they consider when the overall food conversion figure is 10% or more below market weight, that is if the food conversion is less than the weight of the bird, the use of high level antibiotics would not be justified. When the final food conversion figure is within 10% or over the final average market weight of the bird a continuous high level supplementation of aureomycin at the rate of 50 to 100 grammes per ton is indicated and justified. In other words, when the food conversion figure is at about the same as the weight, or more, then high level antibiotic should be used.

The question of whether spot level or intermittent high level or continuous high level antibiotic should be used is a point that is often discussed. Obviously if it is given as a preventive against some of the diseases spot treatment is in-

effective and continuous treatment necessary; for the actual treatment of disease then of course the position is different and birds can be treated during the course of the disease and for about a week afterwards.

There has been much talk recently about the development of resistant strains of bacteria, when antibiotics are fed in the food to livestock. It seems clear that some investigators have found coliform organisms resistant on laboratory examination, but so far no work has shown these organisms to be pathogenic. In other words, they have not produced disease. It is difficult to imagine that if any organisms exist at all after antibiotic feeding, as of course they do, they could possibly be anything else but resistant.

If we believe that there is a normal bacterial population in the gut which usually does little more than suppress growth because it is held in check by the host, and we know that once the flood gates are let down and resistance swamped, as happens for example when the animal dies, then these germs multiply unchecked and invade every part of the body.

At times these germs and others more pathogenic multiply and then invade the tissues, but it is very likely that the inclusion of low levels of antibiotic can on many occasions prevent the "spill over" of bacteria out of the gut into the tissue where they multiply and cause harm and disease there. There surely can be little doubt that it is easier to control such germs before they multiply and appear in force, and this we believe antibiotics will do effectively. It is better to prevent such an increase than allow it to happen, and then try to suppress it.

A survey has been carried out in America to ascertain the effects of continuous feeding of chlortetracycline to up to 18 months, at levels of from 5 to 100 milligrams per pound of ration and no evidence was found of any deleterious effects. The majority of investigators have reported improvement in growth, reproduction and a reduction in mortality.

The use of antibiotics as food supplements in no way suggests the relaxing of ordinary standards of hygiene and management, but so long as birds are kept intensively and so long as labour remains a problem an effective and safe means of reducing the subclinical level of infection can have no reasonable opposition. It is true that this constant level can be reduced by isolation and good management and stringent sanitation and disinfection, but it is not possible in intensive poultry keeping to maintain the uncertain reduction of such an invasion and recourse to antibiotic supplementation is therefore justified in my opinion.

SOME OBSERVATIONS ON THE HAEMORRHAGIC SYNDROME IN CHICKS*

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This paper discusses the incidence and nature of this condition as it occurs in England and Wales, together with data collected from investigations on field outbreaks and from associated laboratory experiments. Since these experiments are incomplete my observations are confined to facts and no attempt is made to interpret the findings nor to explain certains aspects of the condition.

The haemorrhagic syndrome was first reported in Great Britain about 1951[1] and its incidence has gradually increased to the present time. Fortunately it is not an important cause of mortality and has not so far shown the increase in incidence that has occurred in the broiler areas of America.[2] Nevertheless, cases that do arise can have dramatic results and involve severe financial loss.

Various theories regarding the cause of this condition, which are mostly of American origin, have been advanced. These are as follows:—

1. An avitaminosis K.[3]
2. The use of sulphonamide drugs[4].
3. The use of tri-chlorethylene extracted from soya bean meal.
4. An expression of a lack of vitamin C.
5. An expression of an excessive amount of vitamin A[5].
6. The absorption of toxins produced in the food by moulds.
7. The use of dietary antibiotics[5] and other growth stimulants.
8. An insufficient quantity of sulphur in the diet[6].

It will be obvious that the present picture is confused and that the precise cause is still unknown. For this reason the term "syndrome" is used, implying that there may be several different or possibly related conditions each having a different cause but showing a similar clinical and pathological picture.

SYMPTOMS AND COURSE

On first appearance the haemorrhagic syndrome may be confused with an attack of caecal coccidiosis. The affected birds stand huddled up, shiver, sometimes pass blood in their droppings and may die quickly. In many cases death may oc-

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cur without previous symptoms having been observed, the dead birds usually being in ogod bodily condition. The symptoms are the same in all cases regardless of the age of the birds involved.

Usually several members of a flock are affected at the same time and once the condition starts there is a rapid and sudden increase in mortality. The maximum mortality level usually occurs within a few days of the onset of deaths. This level continues for up to about ten days and gradually subsides so that the appearance and disappearance of the condition is completed usually within three weeks. Occasionally only one or two isolated deaths occur simultaneously in a flock. Exceptionally, deaths will continue for a longer period than three weeks but even in these cases it is usually on a gradually decreasing scale. The maximum daily mortality being reached soon after the onset of deaths.

INCIDENCE

Our post-mortem records over the last year show that the incidence of the condition is about half of 1 percent. of all batches of birds examined. This represents about thirty outbreaks investigated and some one hundred birds examined. In these outbreaks the mortality varied from 1 - 50 percent., the average being about 10 percent.

All the commoner heavy breeds have been involved, and the usual light heavy and reciprocal crosses; but it has been uncommon in light breeds.

Both sexes seem to be affected equally and in some broiler outbreaks where as-hatched chicks were being used comparable losses occurred in both sexes. In an outbreak in a breeding flock, mature cockerels as well as the pullets were affected.

The earliest cases experienced were in 7 week old chicks and the commonest age range is between 7 and 12 weeks. Very young chicks do not seem to be affected, but we have seen cases in birds up to ten months old. There appears to be no relationship between the age of the birds affected and the severity of the mortality experienced.

POST-MORTEM FINDINGS

Post-mortem findings are essentially those of an acute anaemia. They consist of multiple haemorrhages of various sizes in the muscles, subcutaneous tissue or internal organs. It is these lesions which give the condition its name, although they may not be constantly present even in acute cases. There

may be some similarity between these lesions and the lesions of coccidiosis or even the acute form of fowl pest.

A lesion constantly present in every bird examined has been a degeneration of the red bone marrow of the long bones. Closer examination of marrow tissue showed a complete cessation of blood cell formation in every case.

There has been nothing to suggest that a vitamin K deficiency has been involved.

ASSOCIATED FACTORS

Of 32 cases investigated during the last year, 27 flocks had recently received sulphonamide drugs in the drinking water. The remaining five cases had received a mash containing a coccidiostatic drug at a preventative level, the exact nature of the coccidiostat involved being unspecified. This apparently close association between the administration of sulpha drugs and the subsequent appearance of the condition has given rise to the term "sulpha drug poisoning". We have no record of an outbreak unassociated with the use of a coccidiostatic drug at some time, although there have recently been reports of such cases in this country and several similar reports from America. In these cases it is sometimes difficult to be certain whether a coccidiostat is being given preventatively in the food or not. In view of the widespread use of coccidiostats for the prevention and treatment of coccidiosis it is only fair to draw attention to the comparative rarity of the haemorrhagic syndrome.

Other associated factors observed have included hot weather, the recent caponising of male birds, or the presence of intercurrent disease. Of these factors the most significant appear to be coccidiostatic drugs and hot weather.

Intercurrent diseases noted have been fowl paralysis or lymphoid leucosis, blackhead and coccidiosis. In each case the disease having occurred before the haemorrhagic syndrome appeared.

It may also be of significance that no cases of haemorrhagic disease have been encountered in turkeys, despite the fact that coccidiosis is an important disease in that species and that coccidiostats are commonly used in turkey starter mashes.

EXPERIMENTAL

Early investigation into outbreaks of haemorrhagic disease has been hampered by difficulty in obtaining live specimens for more detailed study, in view of the rapidity of death.

Attempts of different workers[2,4] to reproduce the field condition in the laboratory have been entirely successful and most work has been done on the effect of vitamin K deficient diets[7,8] or induced vitamin K deficiencies and on the possible toxic effects of various sulphonamides[4,9,10].

It was decided to repeat the attempts to reproduce the condition experimentally. The two main investigations have concerned blood counts and prothrombin times of birds being given sulphonamides in the hope that this information might throw some light on the significance of anaemia as a possible cause, as well as to investigate any effect on the vitamin K metabolism.

Over several experiments it has become obvious that the use of sulphonamide drugs at the normally recommended therapeutic levels causes a constant depression in the production of red blood cells and granulocytes. This effect is reversible and within 48 hours of the cessation of sulphonamide treatment the blood picture in the majority of treated birds returns to normal.

The prothrombin time is only slightly increased by sulpha drugs and not to the extent that it is increased in birds on a vitamin K deficient diet. Again, prothrombin times return to normal on the cessation of treatment but take somewhat longer to reach this level.

In these experiments no deaths occurred at all; and even when massive doses of sulpha drugs were used no deaths occurred. These massive doses caused no greater pathological changes in the blood picture or prothrombin times than occurred when using therapeutic levels. This apparent lack of toxicity of massive doses of sulpha drugs has been demonstrated in America by Cuckler and Ott[9] and would seem to invalidate suggestions that overdosage with sulpha drugs *per se* is to blame for outbreaks of haemorrhagic disease.

Consideration of the field evidence and experimental results indicated that anaemia seemed to be the most likely cause of actual mortality in field cases. And that some additional factor or factors which could further depress blood cell production beyond that induced by sulpha drug administration might be responsible for actual outbreaks of Haemorrhagic. Disease. Alternatively, certain strains of birds might be more susceptible to this depressing effect on blood cell production of sulphonamide drugs. However, a test of several breeds and crosses showed in all cases, the same depression in blood cell production, but no mortality.

Recently, by applying what may be termed "a stress factor" we have constantly been able to kill a proportion of our experimental birds which showed on post-mortem examination the typical signs and lesions of haemorrhagic disease.

This work is still in progress and will be reported in detail later. It must be pointed out, however, that those birds that died had previously shown blood counts which had dropped progressively to well below the level reached when using sulphonamides only. Ultimately red cell counts were obtained which were about one sixth that of the normal level, and granulocytes had disappeared from the blood picture altogether. At this point sudden death from acute aplastic anaemia ensued.

On post-mortem examination these birds showed typical multiple haemorrhages and petechiation and an examination of the bone marrow showed it to be exactly the same as the bone marrow of field cases, namely, replacement of heamopoietic tissue by fatty infiltration which is consistent with a diagnosis of *acute aplastic anaemia.*

The prothrombin time of these same birds before death was only sightly increased and no more so than in the cases where sulphonamides had been administered and death had not ensued.

SUMMARY

It would appear, therefore, that the typical haemorrhagic disease occurring in the field in this country is unrelated to an avitaminosis K and results from a combination of depressing factors affecting blood cell production. One of these factors may be the use of sulpha drugs. The other is being investigated at the moment.

While we are not yet in a position to offer precise recommendations for the control of haemorrhagic disease, the following suggestions can be offered:

An accurate diagnosis is essential since in many outbreaks sulphonamide drugs have been administered when there was little or no evidence that coccidiosis did, in fact, exist in the flock. In cases where treatment for apparent coccidiosis does not appear to clear it up it is vital that further birds are examined before deciding to embark on a second course of treatment since this can be disastrous if losses have already commenced from haemorrhagic disease.

Particular care should be taken during spells of hot weather and it may be worthwhile at such times to consider

the use of a coccidiostat given in the food instead of the drinking water. Especial care must be taken if birds have recently been caponised or if intercurrent disease is known to be present in the flock.

REFERENCES

1. Gordon, R. F. (1951) Reps. IXth World's Poult. Cong. III, 95
2. Cover, M. S., W. J. Mellen, and E. Gill (1955) Cornell Vet. XLV, No. 3, July, p. 366-386.
3. Bletner, J. K., G. C. Anderson, C. E. Weakley, and J. H. Hare (1953) W. Va. Agr. Expt. Sta. Sci. Bul. 363 (Part II).
4. Davies, S. F. M. and S. B. Kendall (1953) Vet. Rec. *65*, 85.
5. Moore, T. and Y. L. Wang (1945) Biochem. Jour. *39*, 222.
6. Almquist, H. J. and E. L. R. Stokstad (1937) Poult. Sci. *16*, 261.
7. Bornstein, S. and Y .Samberg (1954) Poult. Sci. *33*, 831.
8. Griminger, P., H. Fisher, W. D. Morrison, J. M. Snyder and H. M. Scott, (1953) Science, *118*, 379.
9. Cuckler, A. C. and W. H. Ott (1955) Poult. Sci. XXXIV, No. 4.
10. Joyner, L. P. and S. F. M. Davies (1956) J. comp. Path. *66*, 39.

FIRST AUSTRALIAN POST-GRADUATE COURSE IN POULTRY SCIENCE

History was made on January 21, 1957 when, at the School of Agriculture, University of Melbourne, the first post-graduate Poultry Science course ever held in Australia was opened by the representatives of the sponsoring organizations, Prof. Sir Samuel Wadham (Dean Faculty of Agriculture), Sir Ian Clunies Ross (Chairman, Commonwealth Scientific and Industrial Organization), and Mr. P. Ryan, (Director, Victorian Dept. of Agriculture).

The course will last for 10 weeks and cover all scientific aspects of poultry production. Lecturers were drawn from the staff of the CSIRO Poultry Research Centre, the University of Melbourne, the Dept. of Agriculture and the Commonwealth Bureau of Agricultural Economics.

Thirteen poultry officers from 6 different State Depts. of Agriculture attend the course, and one Indian graduate under the auspices of the Colombo Plan.

The course will fill a gap in the academic education of poultry extension and research workers, as Poultry Science is not included in the syllabus of the ordinary degree courses. The Commonwealth Dept. of Primary Industries made funds available to finance the course considering the better training of Poultry officers as an important step towards further improving the efficiency of the Australian poultry industry.

(F.Skaller)

REVIEW OF POULTRY PUBLICATIONS

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GENETICS

ASMUNDSON, V. S., and JULIAN, L. M. 1956. (Dept. Poult. Husb., Univ. California, Davis.)

INHERITED MUSCLE ABNORMALITY IN THE DOMESTIC FOWL. *J. Hered., 47:* 248-252.—A hereditary muscular abnormality similar to certain muscular dystrophies in man has been observed in New Hampshire fowls. Affected birds are unable to right themselves when placed on their backs on a flat surface. Most of the major muscles become enlarged, but the enlargement is frequently followed by atrophy. The time of onset of the abnormality varies. Most of the classifications were made at 8 wks. of age or later, but sometimes the dystrophy could be detected at 4 wks. Gain in weight is a little slower in the abnormal birds, but mature weight is not affected. The bones are slightly shorter than normal. From the results of test matings made by A.I. it is concluded that the condition is probably due to a simple autosomal recessive gene, *am*, the effects of which are breast width and other traits may be modified by the action of many other genes. Homozygous birds have wider breasts than heterozygotes, and heterozygotes have wider breasts than birds not carrying the *am* gene. (Animal Breeding Abstracts)

BERNARDINI BATTAGLINI, M. 1956. (Ist Zoocolt., Univ. Perugia.) Relazione fra precocità d'impiumamento e precocità nello sviluppo somatico.

RELATIONSHIP BETWEEN RATE OF FEATHERING AND RATE OF GROWTH. *Ann. Sper. agr., N.S. 10:* 2171-2188. [English summary.]—Live weight at 60 days in 700 White Leghorn and New Hampshire birds was compared with degree of feathering at birth, at 30 days and at 6 and 8 wks. There were significant live weight differences in favour of birds with a rapid rate of feathering, and it is concluded that there is a genetic association between growth and feathering rate. (Animal Breeding Abstracts)

CRITTENDEN, L. B., B. B. BOHREN, and V. L. ANDERSON. (Purdue U., Lafayette, Indiana.)

GENETIC VARIANCE AND COVARIANCE OF THE COMPONENTS OF HATCHABILITY IN NEW HAMPSHIRES. *Poultry Sci. 36(1):* 90-103. 1957.—Estimates of the heritability of fertility, hatch

of all eggs set and hatch of fertile eggs were obtained from the records of 1030 pen-mated New Hampshire pullets from a flock averaging high in hatchability. The estimates obtained were .005, .041 and .021 by the intra-class correlation technique, and .02, .06 and .03 by the intra-sire regression of daughter on dam for the traits in the order listed above considering them as traits of the pullet. The genetic correlations were found to be positive but extremely variable. Estimates of the variance in these traits contributed by the sire and the dam of the mating producing the eggs were estimated as follows: fertility 17.2% sire—70.3% dam; hatch of fertile eggs 1.7% sire—73.9% dam. The heritability of embryonic viability calculated from the intraclass correlation of half-sib embryos was estimated to be .068 when about 80 eggs were hatched per mating. The relationships of these traits considered as traits of the female measured in pen matings or single male pedigree pen matings were discussed.—*L. B. Crittenden.* (Biological Abstracts)

CRITTENDEN, L. B., B. B. BOHREN, and **V. L. ANDERSON** (Purdue U., Lafayette, Indiana.)
A COMPARISON OF DIFFERENT CRITERIA OF SELECTION FOR HATCHABILITY IN CHICKENS. *Poultry Sci. 36(1):* 104-110. 1957.—The expected genetic gain in hatch of all eggs set was investigated theoretically using different criteria of selection and previously estimated genetic parameters. It was found that the genetic gain was expected to be about the same whether an index using hatch of fertile and fertility was used or hatch of all eggs set was measured itself. A comparison was made of selection of pullets for hatch of all eggs set in a preliminary fall hatchability test with the selection of hens in single male mating pens. Family selection with a large number of full-sibs in the preliminary test was found to be as efficient as individual selection in single male matings. Practical advantages of a preliminary test were discussed.—*L. B. Crittenden.* (Biological Abstracts)

DEMPSTER, EVERETT R., and **L. MICHAEL LERNER.** (U. California. Berkeley.)
MULTIPLE SHIFTS FOR TESTING COCKERELS. *Poultry Sci. 36(1):* 143-146. 1957.—The use of multiple shifts for testing cockerels is discussed. No evidence in favor of such a program has ever been presented, and it is concluded that gains under this scheme were more than matched by those under a single shift procedure. Hence, the multiple shift scheme should not be advocated.—*I. M. Lerner.* (Biological Abstracts)

GEFLUGELHOF. 1956. Das Mechelner Huhn.
MALINES FOWLS. *Geflügelhof, 19:* 128-130. From abstract in *Referat. Z., Biol.*, 1956, No. 20, No. 88609.—The Malines is a heavy breed yielding meat of good quality. Body weight averages 2.5-4.0 kg. in ♀♀ and 3.5-5.0 kg. in ♂♂. Egg production averages 190 per year, and egg weight 60-63 g. They are bred in Belgium, Holland and Switzerland, and to a small extent in Germany. (Animal Breeding Abstracts)

HALE, R. W. 1956. (Minist. Agric. Northern Ireland, Belfast.)
OBSERVATIONS ON THE SHELL STRENGTH OF HEN EGGS. *Res. exp. Rec. Minist. Agric. N. Ire., 1954, 4:* 34-40.—A simple and inexpensive method for testing the shell strength of an egg is described. A steel ball is allowed to fall on the egg from increasing heights until the shell cracks. The method gave rather variable readings, as between different eggs from the same hen, in part due to occasional difficulty in determining the exact end point of the test, *i.e.*, the height of fall which first cracked the eggs. The method was much more variable in this respect than the thickness of the shell and the sp. gr. of the egg.
When the steel ball method was used on a flock of 312 White Wyandotte pullets, the heritability of the shell strength was found to be 0.551. (Animal Breeding Abstracts)

HENDERSON, E. W. 1956. (Dep. Poult. Husb., Michigan State Univ., East Lansing.)
A "BREED" DIFFERENCE IN WEIGHT OF EGGS AND SIZE OF CHICKS. *Quart. Bull. Mich. agric. Exp. Sta., 39:* 42-46.—Using individually pedigreed eggs, comparisons of av. egg weight, av. chick weight at hatching and chick weight as percentage of egg weight were made between White Leghorns, Rhode Island Reds, Barred Rocks, White Cornish × B.R., Dark Cornish × W.L., and miscellaneous Cornish crosses. Chick weight as percentage of egg weight averaged 64.6 and there was no significant difference between purebreds and crossbreds. Between egg weight and chick weight there was a highly significant correlation in all breeds, varying between breeds from 0.50 to 0.86 (av. 0.80). (Animal Breeding Abstracts)

JULL, MORLEY A. (U. S. O. M. Amer. Embassy, Cairo, Egypt.)
PROGENY TESTING FOR HIGH EGG PRODUCTION. *World's Poultry Sci. Jour. 12(4):* 275-279. 1956.—For effective testing it is desirable to mate over 15 females to one male using 3 families of 5 or more full sisters, each.—*J. B. Christiansen.* (Biological Abstracts)

KAWAHARA, T. 1956.
A NEW MICROMELIC MUTANT DOMESTIC FOWL. *Rep. nat. Inst. Genet. (Jap.)* [*Misima, Sizuoka-Ken*], *No. 6 (1955):* 15-16.—In the 1955 hatching season 7 micromelic embryos were obtained from White Leghorn brother-sister matings. Most of the affected embryos survived to the end of the incubation period but none hatched. They were characterised by reduction in the length of the long bones of both extremities and in the length of the beak (particularly the upper beak), by imperfect calcification of the bones, and by the highly viscous nature of the amniotic and allantoic fluids right up to the end of incubation. The results of test matings have indicated that the condition is due to a simple autosomal recessive gene. (Animal Breeding Abstracts)

KING, J. O. L. 1956. (Fac. Vet. Sci., Univ. Liverpool.)
POULTRY BREEDING FOR INCREASED PRODUCTION, WITH SPECIAL REFERENCE TO HEALTH. *Vet Rec., 68:* 994-998. Discussion: 998-1004. (Brit. vet. Ass.)—One of the most important factors in the economics of poultry husbandry is the high mortality rate, the most frequent causes of death being diseases of the avian leucosis complex and the fowl paralysis group. Although it has been shown that resistance to leucosis is inherited, the selection and breeding of disease-free strains is not feasible in commercial poultry undertakings; even if it were carried out, the result might be a strain of poor layers. The main criterion for selection is high egg yield, but care should be taken to maintain a high standard of constitutional vigour.
The various breeding methods employed by breeders of purebred stock and by commercial breeders are outlined, and the system of progeny testing by which a sire is evaluated on the performance of his daughters is described. (Animal Breeding Abstracts)

MULLER, H. D. 1956. (VE-Geflügelhof, Wittenburg.) Versuch über die Auswahlbefruchtung und Heterospermie bei Hühnern. (Vorläufige Mitteilung.)
SELECTIVE FERTILISATION AND HETEROSPERMY IN HENS. (PRELIMINARY REPORT.) *Tierzucht, 10:* 345-348.—Six Rhode Island Red hens were mated on alternate days with R.I.R. and a White Leghorn ♂ from 28th May to 12th June. From the 56 eggs laid 28 chicks hatched; 18 were brown (R.I.R. type), 6 were yellow (Leghorn type), and 4 were black with a yellow fleck on the head. At 10 wks. of age observations were made on feathering and conformation. The brown chicks were all R.I.R. type, but were not fully feathered. Of the 5 yellow chicks which survived, 4 were Leghorn type (2 had a black feather each and the other 2 a few brown and black feathers), and 1 had the shape of a R.I.R. ♂ with some brown and black feathers on the back. The chicks which were originally black were dark and faintly

speckled and were all ♀♀. In body conformation they resembled heavy Leghorn hens. The speckled birds are believed to be due to a heterosis effect rather than to polyspermy. Reference is made to Russian work on polyspermy. (Animal Breeding Abstracts)

PILLA, A. M. 1956. Risultati ed osservazioni relative all'allevamento di meticci, derivati dall'incrocio fra diverse razza di polli, allevati in gabbie per la produzione di carne.

RESULTS OF CAGE-REARING VARIOUS BREED CROSSES FOR MEAT PRODUCTION. *Riv. Zootec., 29:* 365-369.—Growth up to 70 days of 2-breed crosses between Rhode Island Red, White Leghorn, Plymouth White and New Hampshire chicks reared in batteries was compared; in all, 504 crossbreds were involved. Results are tabulated and discussed. Growth rate and efficiency were highest in the P.W.×N.H. cross, which consumed 2.3 kg. food per kg. live weight at 70 days, which averaged 1.38 kg. In all birds, correlations were established between live weight of purebred parents and 70-day weight of crossbred offspring ($r = 0.637$). There was no correlation, however, between rate of growth and rate of feathering in the crossbreds. (Animal Breeding Abstracts)

ROBBLEE, A. R. (U. Alberta, Edmonton, Canada), **RUTH RENNER** and **D. R. CLANDININ.**

SOME OBSERVATIONS ON THE EFFECT OF SELECTION OF MALES ON THE PERCENTAGE HATCH OF TURKEY EGGS. *Poultry Sci. 36(1):* 87-90. 1957.—A study was made of the effect of selection of toms for either upstanding or front-heavy characteristic on the reproductive performance of turkey breeders. Results obtained indicated that the use of relatively upstanding males in the breeding pens resulted in increased fertility of eggs produced as compared to pens in which front-heavy toms were used. The greatest differences in fertility occurred during the early part of the breeding season. The improved fertility in the pens headed by upstanding toms resulted in an increase of 28% in the number of saleable poults from the pens as compared to the number of poults from the pens headed by front-heavy toms. —*A. R. Robblee.* (Biological Abstracts)

SHAKLEE, WILLIAM E. and **C. W. KNOX.** (Agric. Res. Center, Beltsville, Md.)

SELECTION FOR THYROID WEIGHT IN NEW HAMPSHIRE CHICKENS. *Jour. Heredity 47(5):* 211-212. 1956.—Selection of high and low lines based on thyroid weights of 4-week-old New Hampshires was highly effective. Heritability was estimated at 77% and 92% by 2 different methods. The correlation between thyroid weight and body weight was 0.59.—*W. E. Shaklee.* (Biological Abstracts)

TARAN, M. 1956.

REMARKS ON THE RESULTS OF THE RANDOM SAMPLE LAYING TEST OF 1955-56. *Meshek Ha'offot* [*Mon. Publ. Israel Poult. Breed. Ass.*], *3(2):* 55-57.—The second random sample laying test on Leghorns conducted in Israel (at the Government Livestock Farm at Acre) was completed by the end of Aug. 1956, when the birds reached the age of 500 days. Hatching eggs from 40 breeding farms had been collected at random, and from these 2006 pullet-chicks were hatched in April 1955. Five mths. later, 1792 pullets remained (89.5%), which were housed in individual laying cages. The av. hen-housed production was 186 eggs (range 150-220) with an av. mortality, in absence of culling, of 13.8% (range 2.2-27.6%) approx. one half of the mortality was caused by obvious cases of leucosis (visceral lymphomatosis). Sexual maturity was reached after an av. growing period of 174 days (range 167-179 days). The av. body weight of the pullets was 1.815 kg. at 10 mths. of age (range 1.725-1.925 kg.), and at the age of 500 days it was 1.880 kg. (range 1.700-2.050 kg.). Egg weights were determined in Feb. and ranged from 55.6 g. to 61.5 g. (average 58.9 g.) The av. daily feed consumption per Leghorn layer was 117 g., and on the average 187 g. of feed were required to produce 1 egg.—*S. Bornstein.* (Animal Breeding Abstracts)

VAN ALBADA, M. 1956. (State Poult. Breed. Inst., Beekbergen.) Kwantitatieve genetica bij hoenders.

QUANTITATIVE GENETICS IN POULTRY. *Genen en Phaenen, 1 (6/7):* 17-27.—Stress is laid on the importance to the breeder of knowing the relative effects of genotypic differences on phenotypic variation. A critical examination is made of different statistical methods of calculating heritability, particular attention being paid to the reliability of the methods evolved by Lush and Lerner.

In poultry the egg production factors with the highest heritability, arranged in order of heritability, are: age at 1st egg, age at last egg, av. laying cycle over the whole laying year, length of the laying year, av. egg weight, winter egg production, annual production expressed (*a*) in number of eggs and (*b*) in egg weight, and av. length of cycle in the first 7 mths. of production. Mass selection appears to be effective in the case of characters with high heritability. For characters with low heritability individual selection is not very effective and family selection is to be preferred.

From investigations involving a comparison of the annual egg production (in kg.) of dam and daughter groups mated to the same cock it was found that better results are to be expected by selecting the dams for av. length of the laying cycle in the first 2 mths. of laying than by selecting for number of eggs. Age at first egg and age at last egg were also important characters for which to select. (Animal Breeding Abstracts)

WARREN, DON C.

THE RECENT PROGRESS OF POULTRY BREEDING IN AMERICA. *World's Poultry Sci. Jour. 12(4):* 292-298. 1956.—This report given in Japan stresses the importance of private breeding work rather than by government support, and the future importance of in-, and cross-breeding.—*J. B. Christiansen.* (Biological Abstracts)

ZUBAREVA, L. A. 1956. (Inst. Genet., Acad. Sci. U.S.S.R.) Effektivnostj mezporodnogo skrescivanija kur porody russkaja belaja s petuhami porody nju-gempsir i pervomaiskaja.

THE EFFECTIVENESS OF CROSSING RUSSIAN WHITE HENS WITH NEW HAMPSHIRE AND PERVOMAI COCKS. *Dokl. Akad. seljskohoz. Nauk Lenin., 21(5):* 43-48.—Experiments were carried out in 1954 and 1955. The hatchability of 395 fertile eggs laid by Russian White ♀♀ served by Pervomai ♂♂ was 84.8%, and that of 341 eggs laid by Russian White ♀♀ served by New Hampshire ♂♂ was 74.1%; it was 67.2% of 792 eggs produced by purebred Russian White matings. Incubation took several days less for the crossbred chicks than for any of the parent breeds. Mortality during brooding was 2-3 times less for crossbreds than for purebreds. Body weight to 1 yr. was greater for the crossbreds than for the Russian Whites, being greatest for the crossbreds sired by New Hampshires. At 3 mths. testis weight was considerably greater in the crossbreds than in the purebreds. Age at 1st egg was not appreciably different for the Russian Whites and the crossbreds sired by New Hampshires; it was 10 days more for the crossbreds sired by Pervomais. The egg production of the crossbreds was slightly lower than that of the Russian Whites and considerably higher than that of the other parent breeds. Food utilisation was most efficient in crossbreds sired by New Hampshires and more efficient in the other crossbreds than in Russian Whites. (Animal Breeding Abstracts)

PHYSIOLOGY

BUMGARDNER, H. L., and C. S. SHAFFNER. (U. Maryland, College Park.)

PROTEIN-BOUND IODINE LEVELS OF THE CHICK. *Poultry Sci. 36(1):* 207-208. 1957.—The protein-bound iodine in the blood of

chickens was investigated and found to be only approximately half that reported in mammals. Considerable variation was seen between various samples, but analysis of variance of the data did not indicate that there were any significant differences between lines of birds used, sexes, sires, or dams within sires.—*C. S. Shaffner.* (Biological Abstracts)

COOK, D. L., R. A. EDGREN, and **T. W. HARRIS.** (Div. Biol. Res., G. D. Searle and Co., Chicago.)
ANDROGEN INHIBITION OF ATHEROGENESIS IN PULLETS. *Circulation Res. 5(1):* 54-57. 1957.—Continuous testosterone propionate (3 mg) administration inhibited coronary atherogenesis in pullets fed a diet containing 1% cholesterol and 5% cottonseed oil for a period of 8 weeks. This inhibition was associated with a reduction in plasma cholesterol, phospholipids and turbidity. The reduction in cholesterol was greater than for phospholipid thereby decreasing the C/P ratio. A close relationship existed between depression of the C/P ratio and inhibition of coronary atherogenesis. Aortic atherogenesis was not affected. Pretreatment with testosterone proprionate for 2 weeks prior to feeding the cholesterol diet for 8 weeks did not affect significantly the course of cholesterol-induced coronary or aortic atherogenesis.—*D. L. Cook.* (Biological Abstracts)

DRAPER, H. H., and **J. A. FIRTH.** (U. Illinois, Urbana.)
THE REGRESSION OF THYROID WEIGHT ON BODY WEIGHT IN THE GROWING CHICK AND THE INFLUENCE OF PENICILLIN. *Poultry Sci. 36(1):* 42-45. 1957.—Female chicks (394) of New Hampshire X Columbian breeding were examined, in replicated groups of 6 to 15 birds, for changes in thyroid weight in relation to body weight over a body weight range of approximately 200-750 g. The influence of including procaine penicillin in the diet on thyroid weight and body weight also was determined. The regression of thyroid weight on body weight over the specified body weight range was represented by the equation $Y = 0.102\ X^{0.94}$ where X = body weight in grams and Y = thyroid weight in milligrams. An increase in body weight in penicillin-fed birds was observed in only one of three consecutive comparisons, and in this instance a highly significant ($P = <.01$) increase was found in the thyroid weight:body weight ratio. A significant difference in this ratio also was observed between two consecutive experiments in birds fed the basal diet.—*H. H. Draper.* (Biological Abstracts)

DRIGGERS, J. C. 1954. (Florida Agric. Exp. Sta., Gainesville.)
PRODUCING HATCHING EGGS IN CAGES BY MEANS OF ARTIFICIAL INSEMINATION. *Bull. Fla. agric. Exp. Sta., No. 551:* 16 pp.—The technique of collecting semen from the cock is described. Variation in amount and quality occurs between collections from the same bird, and between birds, but a good average is 1 $cm.^3$ per collection; the semen should be whitish and relatively thick. The optimum frequency of collection is once a day.

In the process of insemination, the introduction of semen directly into the oviduct rather than the cloaca results in a higher degree of fertility. This necessitates manipulation of the ♀ so as to effect extrusion of the oviduct. After insertion of the syringe, release of the semen is delayed until the oviduct is withdrawn into the cloaca. A satisfactory av. amount is an injection of 0.10 $cm.^3$ per hen per wk.; larger amounts are wasteful. Using undiluted semen, 1 ♂ to 40-50 hens is about right, and a fertility rate of 90% may be expected.

Dilution of semen 9:1 with egg white or yolk has given disappointing results, the fertility level never being above 35%. No fertility was evident when diluted semen was used after storage for 36 hrs. at 55° F.

A type of cage which facilitates quick handling of the ♀♀ is described. (Animal Breeding Abstracts)

FISHER, A. E., and **HALE, E. B.** 1956-57. (Dept. Psychol., Pennsylvania State Univ., University Park.)
STIMULUS DETERMINANTS OF SEXUAL AND AGGRES-

SIVE BEHAVIOR IN MALE DOMESTIC FOWL. *Behaviour, 10:* 309-323. [German summary.]—Stimulus factors eliciting sexual and aggressive responses in New Hampshire and Barred Plymouth Rock ♂♂ were analysed by tests with White Leghorn models and live ♀♀ of several breeds. Sexual responses were elicited by all models (♂, ♀, crouching, aggressive stance, normal standing position) but the crouched models were most effective. The cocks were clearly differentiated into model reactors and non-reactors. In general, model reactors were also more responsive to live ♀♀. Males reared in single-breed flocks were more responsive to ♀♀ of their own breed than to those of other breeds. Six ♂♂ reared in isolation waltzed to ♀ fowls but were never observed to mount a crouching ♀. After further experience, 3 of these ♂♂ mounted and copulated by forced matings with standing ♀♀ in preference to mounting ♀♀ already crouching. Females reared in isolation crouched to humans but did not respond to the waltzing of cocks. (Animal Breeding Abstracts)

FRENCH, M. H., and LEDGER, M. A.
THE RATE OF GROWTH AND THE EFFICIENCY OF FOOD CONVERSION IN VARIOUS BREEDS OF POULTRY. *E. African Agric. J., 1956, 22, 60-63.* [Joint Animal Indust. Div., E.A.A.F.R.O., and E.A.V.R.O., Muguga, Kenya.]—In an attempt to assess the growth potentialities of different classes of poultry under conditions in Kenya, North Holland Blue, Brown Leghorn, Welsumner, Calabar and Legbar chicks, Aylesbury ducks and Roman geese, hatched in England, were flown to Muguga (6800 ft.) as day-old chicks. Growth rate and efficiency of feed conversion were comparable with those found in temperate countries. With chickens there was a sharp rise at 14 to 16 weeks in feed consumed per lb. gain in weight. This decreased efficiency occurred earlier in geese and ducks, and it is suggested that ducks should be disposed of under 14 weeks and goslings at 12 to 13 weeks.—*J. S. Thomson.* (Nutrition Abstracts and Reviews)

HUBLE, JAN. (U. Ghent, Belgium.)
GONADAL HORMONES, CHONDROGENESIS AND OSSIFICATION IN THE YOUNG FOWL. *Acta Endocrinol. 23(1):* 95-100. 1956.—Hormonal control of cartilage growth and differentiation was investigated. Daily administration of 100 μg estradiol benzoate for 7 to 8 days produced a significant narrowing of the proliferation zone in the epiphyseal discs of the femur, tibiotarsus and tarsometartarsus of Rhode Island Red chicks. A diminution in the extension of the hypertrophic cartilage area was also seen and it was suggested that this effect is partly due to enhanced endochondral esteogenesis. There was also a dwarfing effect on the 3 long bones. Testosterone proprionate in a daily dose of 300 μg for 9 days decreased the width of the epiphyseal disc but the differences were not statistically significant. Progesterone in a dose of 500 μg/day for 8 days had no significant influence. —*W. R. Slaunwhite, Jr.* (Biological Abstracts)

LAKE, P. E. 1956. (Poult. Res. Centre, Edinburgh.)
THE STRUCTURE OF THE GERMINAL EPITHELIUM OF THE FOWL TESTIS WITH SPECIAL REFERENCE TO THE PRESENCE OF MULTINUCLEAR CELLS. *Quart. J. micr. Sci., 97:* 487-497.—Observations on the cytology of the germinal epithelium in sexually active Brown Leghorn cocks have confirmed that multinuclear cells are regularly formed during spermatogenesis. The development of spermatozoa from multinuclear cells would explain clusters of spermatozoa sometimes observed in stained transverse sections of testis tubules. (Animal Breeding Abstracts)

LAKE, P. E. (Poultry Res. Centre, Edinburgh.)
THE MALE REPRODUCTIVE TRACT OF THE FOWL. *Jour. Anat. 91(1):* 116-129. 1957.—A detailed study was made of the reproductive organs of the male fowl (*Gallus domesticus*). Histochemical methods were used to investigate the production of lipids, muco-substances, alkaline and acid phosphatases in the reproductive tract. An

anatomical examination was made for preliminary observations on the likelihood of various glandular tissues contributing secretions to the semen, as artificially collected by the massage technique. No glands were found to compare with the prostate or seminal vesicles of mammals. Most of the seminal plasma is derived from the lining epithelia of testes, vasa efferentia and vasa deferentia. Erectile tissue in the cloaca, known as vascular bodies and lymph folds, forms part of the copulatory organ. It is considered that epithelial glands of the vascular bodies secrete a fluid similar in composition to that of the bulbo-urethral glands in the bull, i.e. acid mucopolysaccharide in nature. There is intense holocrine secretion in the vasa efferentia and parts of the vasa deferentia, which contributes lipo-protein, mucosubstances and possibly protein and peptide material to the seminal plasma.—*P. E. Lake.* (Biological Abstracts)

LEE, CHENG-CHUN, P. N. HARRIS, R. C. ANDERSON, and **K. K. CHEN.** (Res. Labs., Eli Lilly and Co., Indianapolis, Ind.)

ABSENCE OF THYROID CHANGES BY ERYTHROMYCIN IN CHICKENS. *Antibiot. and Chemother. 7(3):* 132-134. 1957. — Erythromycin fed to chicks, at levels of 5, 10, 50, and 250 g/ton of diet for 6 to 8 weeks, had no apparent effect on the weight of the thyroid gland. There was very little difference in histologic appearance between the thyroid glands of the controls and those of the Erythromycin-treated chickens. It is concluded that the growth response in chickens produced by Erythromycin is independent of the thyroid gland.— Auth. summ. (Biological Abstracts)

LEVEILLE, G., HANS FISHER, and **H. S. WEISS.** (Rutgers U., New Brunswick, N. J.)

RELATIONSHIP BETWEEN ONSET OF EGG PRODUCTION AND PLASMA CHOLESTEROL LEVELS IN THE CHICKEN. *Proc. Soc. Exptl. Biol. and Med. 94(2):* 383-384. 1957—Plasma cholesterol levels were studied as a function of age and onset of egg production in Leghorn pullets. Following a highly significant increase of 146% with peak value corresponding closely to time of 1st egg, plasma cholesterol decreases significantly from peak value to 79% above initial value. It is suggested that this relationship be considered when choosing birds for experimental studies on cholesterol metabolism.— *G. Leveille.* (Biological Abstracts)

LOHLE, K. and **STRECKE, J.** Untersuchungen über einige Organgewichte bei rebhuhnfarbigen Italienerküken.

ORGAN WEIGHTS OF BROWN LEGHORN CHICKS. *Deutch. Wirtschaftsgeflügelzucht, 1957, 9,* 104-105. [Inst. Tierzucht, Friedrich Schiller Univ., Jena.]—Mean weights of heart, liver and gizzard of day-old Brown Leghorn chicks were greater in males than in females, but the differences were too slight for use in sexing. For the sexes together there were statistically significant correlations between organ weight and bodyweight, $r = 0.58$, 0.62 and 0.74, respectively.—*W. M. Deans.* (Nutrition Abstracts and Reviews)

MORITA, SHIGEHIRO, and **SCHIICHI NISHIDA.** (U. Tokyo.)

HEMATOLOGICAL AND HISTOLOGICAL CHANGES INDUCED BY ADRENOCORTICOTROPIC HORMONE (ACTH) AND FORMALDEHYDE STRESSOR IN THE DOMESTIC FOWL. *Endocrinol. Japonica 3(1):* 39-49. 1956.—Changes of percentage of leukocytes in the adult chicken blood induced by ACTH injection and histological changes of lymphoid tissues and adrenals in the young chick induced by formaldehyde stressor, were examined.—Authors. (Biological Abstracts)

POLIN, DONALD, PAUL D. STURKIE, and **WALTER HUNSAKER.** (Rutgers U., New Bruswick, N. J.)

THE BLOOD CALCIUM RESPONSE OF THE CHICKEN TO PARATHYROID EXTRACTS. *Endocrinology 60(1):* 1-5. 1957.—Laying hens and cocks respond maximally to parathyroid extracts, 3-4 hours after subcutaneous injection of 100 units. The laying hen showed

a greater blood Ca response than the cock or chick. Log-dose response data for the chick are presented and the response was linear over the range of 50-200 units that were employed. One hundred units of parathyroid extract, subcutaneously injected into 5- and 7-week-old chicks and into mature cocks, increased plasma Ca an average of 2.1 mg/100 ml, 3-4 hours after injection.—Authors. (Biological Abstracts)

REMPEL, ARTHUR G. (Whitman Coll., Walla Walla, Wash.), and **HERBERT L. EASTLICK.** (State Coll. Washington, Pullman.)
DEVELOPMENTAL STAGES OF NORMAL WHITE SILKIE FOWL EMBRYOS. *Northwest Sci. 31(1):* 1-13. Illus. 1957.—Descriptions are given for stages 28-46 (about 5.5-6 days to hatching in about 20-21 days) in regard to limbs, face, eyes, beak, brain, feather germs, and cloacal region. Morphological and structural characters are more reliable in classifying stages of development than chronological age.—*R. W. Dexter.* (Biological Abstracts)

RUBIO PAREDES, J. 1956. (Serv. Fisiozootec., Patronato Biol. Anim., Madrid.) Causas y mecanismo de la muda en las gallinas.
CAUSE AND MECHANISM OF THE MOULT IN FOWLS. *Rev. Patron. Biol. anim. [Madr.], 2:* 95-175. [B.] [French and English summaries.]—The moult was studied in 72 Black Castilian fowls, both in intact ♂♂ and ♀♀ and in those deprived of gonads and/or thyroids. They were kept in batteries, and for some the tabulated records of monthly feather losses extend into their 3rd yr. Feathers counted from 1 normal ♂ numbered 4790, and the average for 4 ♀♀ was 5245. A complete change of plumage does not occur at the annual moult. Capons moult more intensively than cocks and have 2 peak periods of feather loss. After sinistral ovariectomy the 1st moult in ♀♀ is of the capon type but the next is like that of the cock. When the right gonad is also removed the capon type is continuous. There is a marked decrease in feather shedding in thyroidectomised birds, as also in those deprived of both thyroids and gonads. Partial ablation of the glands results in less marked changes in the moulting cycle. The author concludes that moulting is regulated by gonad-thyroid interaction and that climatic variations modify the endogenously determined cycle.—*J. S. S. Blyth.* (Animal Breeding Abstracts)

SAEKI, YUICHI, KENTARO HIMENO, YUICHI TANABE, and **TOSHIMATSU KATSURAGI.** (Natl. Inst. Sci., Chiba, Japan.)
COMPARATIVE GONADOTROPHIC POTENCY OF ANTERIOR PITUITARIES FROM COCKS, LAYING HENS AND NON-LAYING HENS IN MOLT. *Endocrinol. Japan. 3(2):* 87-91. 1956.—Assay was made of the gonadotropic potency of the anterior pituitaries obtained from cocks, laying hens and non-laying hens in annual molting, of the Single Comb White Leghorns and partly those of the crossbreds. The degree of response was measured by the increment of the testicular weight of one-day-old cockerels. Pituitaries from cocks were the richest in gonadotropin content and pituitaries from non-laying hens showed a greater potency than those obtained from laying hens.—Auth. summ. (Biological Abstracts)

SCHINDLER, H., R. VOLCANI, and **SH. WEINSTEIN.** (Agric. Res. Sta., Rehovot, Israel.)
A NOTE ON SEASONAL FLUCTUATIONS IN THE MOTILITY OF COCK SEMEN. *Poultry Sci. 36(1):* 194-196. 1957.—The percentage of motile cells was estimated in semen collected on 3 consecutive days in the middle of each month from White Leghorn cocks kept under natural light conditions and fed uniformly during the whole year. Seasonal trends in the motility of cock sperm were found; the percentage of motile cells was high during Jan.-May and low during Aug.-Dec. The motility seems to be closely related to the stage of molt.—*H. Schindler.* (Biological Abstracts)

SCHJEIDE, OLE ARNE (Atomic Energy Project, Sch. Med., U. California, Los Angeles.)
STUDIES OF THE NEW HAMPSHIRE CHICKEN EMBRYO. VII. ULTRACENTRIFUGE PATTERNS OF THE PLASMA LIPOPROTEINS. *Growth 20(3):* 195-212. 1956.—Ultracentrifuge patterns were obtained of the lipoproteins in the plasmas of embryos in various stages of development. These are compared to growth curves of the whole embryo and the liver and to patterns obtained from growing chicks and adult roosters. The sum of the lipoproteins of median density (approximately Sf 3-25 remained fairly constant throughout development, but a shift toward lighter from the denser of such components took place as the embryo increased its synthesis of sterol ester. The Sf 3.5 group was first detectable at hatching. The dense lipoproteins (approximately -S 3-10) were present in relatively low concentration until just prior to hatching. Between 18 days of incubation and 21 days, several-fold increases were seen which seemed to be correlated with the abrupt slowing of growth at this time. A shift from denser toward lighter components occurred after the 16th day of incubation. Chemical determinations on isolated lipoprotein groups reveal that definite ratios of protein to lipid and lipid to lipid prevail for each density group.—Authors. (Biological Abstracts)

VLADIMIRSKAJA, E. M. 1956. (Kiev Vet. Inst.) Izmenenie vidovyh priznakov u recipienta pod vlijaniem geterotransplantacii polovyh zelez.
CHANGES IN SPECIES CHARACTERS IN THE RECIPIENT AFTER HETERO-TRANSPLANTATION OF GENITALIA. *Z. obsc. Biol.*, 17: 459-461.—A 25-day-old purebred White Wyandotte was bilaterally castrated and the testes of a 37-day-old Bronze turkey were transferred to him. Four months after operation the head feathers moulted and the skin of the head was pink; the comb was represented by a skin fold. No spurs developed. The tail feathers were speckled and the tail resembled that of a turkey. These characters were preserved during subsequent development. (Animal Breeding Abstracts)

WARREN, D. C. (Purdue U., Lafayette, Indiana.)
THE PROBLEM OF GEOGRAPHICAL ADAPTATION OF POULTRY. *World's Poultry Sci. Jour. 12(4):* 272-274. 1956.—Based on observations of American and European stocks in Egypt, Turkey, and India, it is concluded that poultry stock developed in Europe and America readily adapt to Asian climate. The genes evolved for adaptation of indigenous stock should be used, as well as desirable imported characteristics. The Fayoumi breed has characteristics possibly desirable in American poultry.—*J. B. Christiansen.* (Biological Abstracts)

WILLIAMS, CLETIS, (Oklahoma A. and M. Coll., Stillwater), and **W. H. McGIBBON.**
THE RELATIONSHIP OF THE VARIOUS MATING BEHAVIOR ACTIVITIES OF THE MALE DOMESTIC FOWL. *Poultry Sci. 36(1):* 30-33. 1957.—The number of matings attempted within a short period of time determines the number of successful completions. The number of escapes by the females from a male was directly proportional to the number of matings attempted by that male. Crouching of a female for a male did not influence greatly the decision of the male to attempt a mating. Escapes by females during attempted mating contributed approximately 1% of the total variation of percent completion of matings attempted. Sexually active males tended to have a lower percent completion of matings attempted than less active males. Waltz-courts by males showed little relationship with other mating behaviors.—*C. Williams.* (Biological Abstracts)

NUTRITION

ANDERSON, G. W., M. M. HAUSER, M. L. WRIGHT and J. R. COUCH. THE EFFECT OF DIETARY ENTEROCOCCI AND CHLORTETRACYCLINE HYDROCHLORIDE IN THE INTESTINAL FLORA AND GROWTH OF CHICKS. *Canad. J. Microbiol., 1956. 2,* 733-739.—[Dept. Bacteriol., Ontario Agric. Coll., Guelph.] To 5 groups, each of 22 chicks, on a standard ration the following supplements were given: group 1, control, none; group 2, chlortetracycline HCl, 40 g. per ton feed; group 3, low level culture of enterococci; group 4, high level culture of enterococci; group 5, high level culture of enterococci plus antibiotic as group 2. The enterococci cultures had been shown to be sensitive to the level of antibiotic given. Growth to 4 weeks was recorded and then 5 birds from each group were killed and intestinal bacteria in duodenum, ileum and caeca were examined.

Groups 2 and 5 grew significantly better and group 4 significantly worse than group 1. The effect of antibiotic in group 5 compared with group 4 was highly significant. Growth in group 3 was only slightly reduced below that of group 1. Efficiency of feed conversion showed the same trends as growth.

Total bacterial count, and numbers of coliform bacteria and enterococci, but not lactobacilli, increased from duodenum to ileum to caeca in all groups. Total counts did not differ among groups, but chlortetracycline reduced enterococci and lactobacilli. The high level of dietary enterococci, but not the low, increased the numbers of intestinal enterococci and decreased coliform bacteria and lactobacilli. The relation between the growth response and the pattern of the intestinal bacteria, and the possible mode of action of chlortetracycline in stimulating chick growth, are discussed.—*T. D. Bell.* (Nutrition Abstracts and Reviews)

CAMP, ARTHUR A., J. R. COUCH, and J. H. QUISENBERRY. (Texas Agric. Expt. Sta., College Station.)
RESPONSE TO DIETHYLSTILBESTROL INJECTIONS OF GROWING CHICKS FED VARIOUS PROTEIN LEVELS. *Poultry Sci. 36(1):* 171-178. 1957.—Three tests were conducted to determine the response of growing birds, fed various protein levels, to subcutaneous injections of diethylstibestrol. Data indicate that the greatest growth response from the hormone injection was obtained on protein levels of 14%, 16% or 18%, particularly on the two lower levels. No growth response was obtained when the birds were fed a 21% protein diet following the injection. Growth rate of the untreated birds increased as the protein level increased. Growth rates of the treated birds on the lower protein levels were not significantly different from either the treated or untreated birds at the higher protein levels. Feed efficiency was improved by the treatment when the birds received a 14% or 16% protein diet during the test period, but was decreased when the birds received 18% or 21% protein. Dressing percentages were variable in these tests but tended to be improved by the hormone in the low protein diets. New York dressed, pigment, fleshing, and finish scores were improved by the treatment, particularly on the 18 and 21% protein. Feather scores were variable but tended to be improved by the injections. These data suggest that favorable responses from treatment with diethylstilbestrol may be dependent upon a high Calorie to protein ratio. The greatest growth response was obtained on a productive energy Calorie to protein ratio of about 60:1. There is need for further research to determine the optimum energy to protein ratio following diethylstilbestrol injections.—*J. H. Quisenberry.* (Biological Abstracts)

COATES, M. E., M. K. DAVIES, R. DAWSON, G. F. HARRISON, E. S. HOLDSWORTH, S. K. KON, and J. W. G. PORTER.
THE ACTIVITY FOR CHICKS OF SOME VITAMIN B_{12}-LIKE COMPOUNDS. *Biochem. J., 1956, 64,* 682-686. [Nat. Inst. Res. Dairying Univ. Reading.]—Ten analogues of vitamin B_{12} were tested for vitamin B_{12} activity in chicks bred from hens given a diet low in vita-

min B_{12}. The only naturally occurring analogue to show activity was 5-hydroxybenziminazole (vitamin $B_{12\,III}$) which had 3.9 per cent of the activity of vitamin B_{12} when given by mouth or 5.1 by injection. Four unnatural analogues containing benziminazole in the nucleotide also showed activity. Two of these, dichlorobenziminazole and naphthiminazole, were almost as active as vitamin B_{12}. Pseudo-vitamin B_{12} and factor B (which has no nucleotide) were prepared from calf faeces. When given in large doses by mouth, they reduced the effect of vitamin B_{12} given simultaneously. Factor D, the chemical constitution of which is unknown, when given by mouth or injection also appeared to antagonise vitamin B_{12}. The naturally occurring factor A and the diaminopurine derivative were inactive, but not antagonistic to vitamin B_{12}. Chromatograms of liver extracts showed that the substances tested reached the liver, and since there was little or no change in the vitamin B_{12} content of the livers, it appeared that the compounds were active *per se* and not through conversion to vitamin B_{12}.—*E. M. Cruickshank.* (Nutrition Abstracts and Reviews)

FANGAUF, R., F. W. KLEIN, and **G. v. BARLOWEN.** Dattein im Geflügelfutter.

DATES IN POULTRY RATIONS. *Deutsch. Wirtschaftsgeflügelzucht, 1957, 9,* 103-104. [Kiel-Steenbek].—The experiment was designed to show to what extent crushed grain could be replaced by crushed dates in all-mash rations for poultry. Day-old New Hampshire chickens were divided into 3 groups. The control group 1 received a normal mixture including crushed grain 58.5 and wheat bran 19 per cent. Group 2 had crushed grain 51, wheat bran 17 and crushed dates 10. Group 3 had crushed grain 43.5, wheat bran 14.5 and crushed dates 20. At the end of 8 weeks, total feed consumption for the 3 groups was 1778, 1724 and 1788 g., respectively. Average bodyweight was 665, 725 and 683 g., respectively. It would therefore be possible to replace up to 15 per cent crushed grain in an all-mash ration by the same amount of dates without adverse effect on growth or feed utilisation.—*M. Lyon.* (Nutrition Abstracts and Reviews)

FERGUSON, T. M., R. H. RIGDON, and **J. R. COUCH.**

THYROID IN B-12 DEFICIENT CHICK EMBRYOS. *Endocrinology, 1957, 60, 13-21.* [Dept. Biochem., Agric. and Mech. Coll. Texas, College Station.]—Hens were fed on a practical type of ration or on a ration deficient in vitamin B_{12} and eggs were incubated (see Abst. 3586, Vol. 25). The vitamin B_{12} content of the eggs of the normal group was from 4 to 15 and of the deprived group from 0.2 to 4 μg. per g. yolk. Thyroids of embryos from the 12th to the 22nd day of incubation were measured; of 31 from the normal group 5 glands had a maximum diameter of 2.0 mm. and none reached 2.5 mm., but of 30 from deficient embryos 22 had one or both diameters greater than 2.5 mm., a significant difference. The thyroids from deficient embryos were slow to differentiate and showed fewer follicles with greater irregularity in size and greater vascularity than normal glands at the same stage of incubation. Development appeared to be retarded by from 24 to 72 hr. In the thyroids from deficient embryos on the 21st day of incubation many follicles were without colloid. The histological picture is shown in 11 photomicrographs.—*D. Duncan.* (Nutrition Abstracts and Reviews)

FERGUSON, T. M., J. R. TRUNNELL, B. DENNIS, P. WADE and **J. R. COUCH.**

THE INFLUENCE OF VITAMIN B_{12} DEFICIENCY ON THE UPTAKE OF I^{131} BY THE THYROID GLAND IN ADULT AND EMBRYONIC CHICKENS. *Endocrinology, 1957. 60,* 28-32. [Dept. Poultry Sci., College Station, Texas.]—Pullet chicks were reared from hatching on a diet deficient in vitamin B_{12}, containing, per cent, soya bean meal 35, ground yellow maize 61, oyster shell flour 1.5, dicalcium phosphate 2 and salt 0.5, with Mn and, per lb. ration, riboflavin 2, calcium pantothenate 5, nicotinic acid 12.5, menadione 0.5, choline chloride 200 mg., vitamin A 4000 I.U., vitamin D_3 800 chick units (I.C.U.) and procaine penicillin 33 mg. At maturity the birds were placed in

laying cages and given a diet containing, per cent., sucrose 62, soya bean protein 24, soya bean oil 3 and salt mixture 11. The vitamins added, in mg. per kg. diet, were vitamin B_1 20, riboflavin 6, calcium pantothenate 15, nicotinic acid 100, pyridoxine 4, *p*-aminobenzoic acid 20, inositol 1000, menadione 0.5, *x*-tocopheryl acetate 24, folic acid 2, biotin 0.2, choline chloride 2000, with vitamin A 10,000 I.U., vitamin D_3 3800 I.C.U., procaine penicillin 33 mg., methionine 7.5 g. and glycine 4 g. A second group of hens reared on a practical farm ration had the synthetic diet from 4 months of age. Some of the hens were artificially inseminated and eggs were incubated so that the embryos might be studied. Uptake of ^{131}I by the thyroids of hens and of embryos was measured.

Average uptake of ^{131}I by the thyroids was less in embryos from hens deprived of vitamin B_{12} than in normal embryos. The percentage of the dose taken up by the thyroid in the 21-day embryo and the day-old chick was on the average 3 in deficient and 25 in normal birds. Thyroids from deficient embryos gave ratios of iodide, monoiodotyrosine, diiodotyrosine and thyroxine which were within the normal range. The sulphydryl content of colloid and cells of deficient thyroids was small, but the disulphide content was normal.

In pullets reared to 3 months of age on the first diet described about 9 per cent of the dose of ^{131}I was taken up by the thyroid in 24 hr. When the same birds were then given added vitamin B_{12} for a month the uptake rose to 15 to 41 percent.

Adult hens which had had the deficient diet for from 12 to 15 months showed an uptake by the thyroid of 0.7 to 2.6 per cent of the ^{131}I injected; in one hen, but not in 2 others, injection of 20 μg. vitamin B_{12} daily for 5 days raised the uptake to 10 per cent. As in the embryos, thyroids of deficient hens were low in sulphydryl groups.—*D. Duncan.* (Nutrition Abstracts and Reviews)

FERGUSON, T. M., H. P. VAUGHT (Texas A. and M. Coll., College Station), **L. D. MATTERSON** (U. Connecticut, Storrs), **B. L. REID,** and **J. R. COUCH.** (Texas A. and M. Coll., College Station.)

THE EFFECT OF DIFFERENT LEVELS OF PRODUCTIVE ENERGY, PROTEIN AND METHIONINE UPON THE GROWTH OF BROAD BREASTED BRONZE TURKEY POULTS. *Poultry Sci. 36(1):* 124-128. 1957.—Broad breasted bronze turkey poults, divided into groups of 55 birds each, were fed basal diets which contained 24, 26 and 28% protein and were fed at two calorie levels, differing by 100 calories per pound. The diets were also supplemented with 0.05% and 0.10% DL-methionine. The maximum growth at 12 weeks was obtained in the group fed 28% protein at a calorie level of 914 calories/lb. and supplemented with 0.5% methionine. Feed efficiency was improved at each protein level when the diet was supplemented with methionine or the energy level was increased. The linear response to increasing levels of protein was significant from 24% to 28%, as was also the negative response to increased calories at each protein level. The response to the inclusion of 0.05% methionine in the diet was marked, but the response to further addition was not significant. The response to methionine was greater at increased energy levels.—*T. M. Ferguson.* (Biological Abstracts)

FOX, M. R. S., L. O. ORTIZ and **G. M. BRIGGS.**

EFFECT OF DIETARY FAT ON REQUIREMENT OF VITAMIN B_{12} BY THE CHICK. *Proc. Soc. Exp. Biol. Med., 1956, 93,* 501-504. [Nat. Inst. Arthritis Metabol. Dis., U.S. Dept. Health, Bethesda, Md.]—Chicks from a hatchery were kept for 4 weeks on all-vegetable diets containing 3 or 22 per cent fat, supplied by lard, alone or supplemented, per kg., with amounts of vitamin B_{12} from 5 to 2000 μg. Some chicks received the vitamin by injection. With the low-fat diet not more than 5 μg. was required for optimum growth; on the high-fat diet between 50 and 100 μg. was necessary. In chicks on the high-fat diet, better growth was obtained from 5 μg. injected than from that amount by mouth. On the unsupplemented diets the content of the vitamin in the liver was independent of the fat intake. Vitamin B_{12}

added to either diet increased liver stores to about the same extent.—*E. M. Cruickshank.* (Nutrition Abstracts and Reviews)

GERSHOFF, STANLEY N., and D. MARK HEGSTED. (Harvard Sch. Publ. Health, Boston.)

EFFECT OF VITAMIN D AND Ca:P RATIOS ON CHICK GASTROINTESTINAL TRACT. *Amer. Jour. Physiol. 187(2):* 203-206. 1956.—The effect of feeding diets containing various Ca:P ratios (4:1, 1:1, 1:2) to rachitic and nonrachitic chicks has been studied. The Ca:P ratios used had no significant effect on Ca absorption in chicks receiving vitamin D but were of importance in the Ca absorption of rachitic chicks. Vitamin D was found to increase Ca absorption in chick duodenum but had no effect on glucose absorption. Increased peristalsis was obtained when vitamin D or the least rachitogenic Ca:P ratio (1:1) was fed. A possible increase in intestinal mucosa respiration was also observed when vitamin D or the 1:1 Ca:P ratio was fed.—Authors. (Biological Abstracts)

HALE, R. W. and W. O. BROWN.

SUNFLOWER MEAL AS A PROTEIN CONCENTRATE FOR LAYING HENS. *J. Agric. Sci., 1957, 48,* 366-372. [Minist. Agric. N. Ireland, Belfast.]—Rations containing 20 per cent crude protein, supplied by cereal meals and 17 per cent fishmeal or 25 per cent sunflower meal, and 12 per cent crude protein, with 2½ per cent fishmeal or 5 per cent sunflower meal, were given to laying pullets for 319 days in one trial and 336 days in another. The birds also got whole oats, 1 oz. each daily. There were 200 pullets in each experiment. Egg production, liveweights and consumption of feed were recorded.

Egg production was not significantly affected by any of the supplements, but on 25 per cent sunflower meal the birds lost weight in one experiment, and did not gain in the other, in contrast to the birds getting the other rations. This was associated with reduced efficiency of utilisation of feed for egg production. It was thought that the fibre content of the ration with 25 per cent sunflower meal was too high. Since the 2 low-protein rations gave comparable performances it was considered that sunflower meal could satisfactorily replace fishmeal in laying rations provided fibre content was not raised too much.—*T. D. Bell.* (Nutrition Abstracts and Reviews)

HARMS, R. H., B. L. REID, and J. R. COUCH. (Texas A. and M. Coll., College Station.)

FURTHER STUDIES ON A FACTOR OBTAINED FROM CONDENSED FISH SOLUBLES WHICH ENHANCES VITAMIN A STORAGE IN CHICK LIVERS. *Poultry Sci. 35(6):* 1254-1259. 1956.—Effect of fractions of condensed fish solubles on vitamin A storage in chick livers was evaluated. Previous reports showed that fish solubles will enhance liver storage of vitamin A. The fish solubles factor in these studies was partially destroyed by autoclaving for 2 hours at 120°C, at a pH of either 3, 7, or 9. The factor was stable to acid treatment (6N HCl) for 6 hours, and was also stable when refluxed for the same length of time at the natural pH of 4.5. Partial destruction of activity occurred upon treatment with 6N NaOH. A portion of the factor responsible for increased vitamin A liver storage was extracted with ethyl ether and could be absorbed on IRA 400 (anion) exchange resin.—Authors. (Biological Abstracts)

HUSSIAN, ANWAR, and ABDUL HALEEM. (Punjab Agric. Coll. and Res. Inst. Lyallpur, Pakistan.)

FEEDING COTTONSEED CAKE (WHOLE PRESSED) AND BERSEEM HAY MEAL TO LAYING PULLETS IN PAKISTAN. *World's Poultry Sci. Jour. 12(4):* 280-285. 1956.—Punjab cottonseed cake containing 0.05-0.25% free gossypol was used on a restricted multiple feed basis with green vegetable waste, onion waste, berseem hay meal, buffalo buttermilk, wheat crumb, dried cow manure, and limestone. The total diet supplied 15% protein, 10% fiber and 3% fat,

and included 20% cottonseed cake. Berseem hay meal, *Trifolium alexandrium* contained 90% dry matter, 12.9% ash, 1.2% fat, 27.7% crude fiber, 13% protein, 1.7% Ca, and 0.33% P. Production of the Rhode Island Reds on this diet was 170-180 eggs/year. Discoloration developed after 28 days storage, but storage is not a problem in Pakistan.—*J. B. Christiansen.* (Biological Abstracts)

JACOBS, HARRY L. (Bucknell U., Lewisburg, Pa.), and **M. L. SCOTT.** (Cornell U., Ithaca, N. Y.)

FACTORS MEDIATING FOOD AND LIQUID INTAKE IN CHICKENS. I. STUDIES ON THE PREFERENCE FOR SUCROSE OR SACCHARINE SOLUTIONS. *Poultry Sci. 36(1):* 8-15, 1957.—Six-week-old chickens were presented with choices of various combinations of 12% sucrose solution, 0.13% saccharine solution, and water. Significantly more sucrose solution and significantly less saccharine solution were selected than would have been expected on the basis of chance. Qualitatively different drinking behavior was seen in the presence of the sucrose solution. When the sucrose and saccharine solutions were suddenly reversed after initial preferences were established, the preference for sucrose was still demonstrated, showing that this preference is reliable under the conditions of these experiments. The presence of sucrose in the drinking water did not produce any measurable effect on rate of weight increase or amount of food intake. Forced feeding of 4*M* dextrose in large quantities significantly lowered preference for sucrose solution in only 1 of 3 tests. On the basis of these results, it is concluded that, under the conditions of these experiments, the chicken (1) can discriminate among sucrose solutions, saccharine solutions, and water; (2) prefers sucrose solution and avoids saccharine; and (3) that the preference for sucrose has not been shown to be related to its caloric value.—*M. L. Scott* (Biological Abstracts)

JENSEN, LEO S., and **JAMES McGINNIS.** (State Coll. Washington, Pullman.)

IMPROVEMENT IN HATCHABILITY OF TURKEY EGGS BY INJECTION WITH WATER SOLUBLE VITAMIN E. *Poultry Sci. 36(1):* 212-213. 1957.—Injection of a water soluble form of vitamin E (*d* alpha-tocopheryl polyethylene glycol 1000 succinate) improved hatchability of vitamin E deficient turkey eggs. No evidence was obtained for improvement of hatchability by injecting two water soluble antioxidants, ascorbic acid and methylene blue—*L. S. Jensen.* (Biological Abstracts)

JONES, RICHARD J. (Dept. Med., U. Chicago), **OSCAR K. REISS,** and **SHELDON HUFFMAN.**

CORN OIL AND HYPOCHOLESTEREMIC RESPONSE IN THE CHOLESTEROL-FED CHICK. *Proc. Soc. Exptl. Biol. and Med. 93(1):* 88-91. 1956.—The high plasma cholesterol induced in cockerels by 6 weeks of feeding 1% cholesterol and 10% cottonseed oil (988 mg%) was significantly reduced (659 mg%) by substituting corn oil for the fat vehicle. When distilled fatty acids of cottonseed oil were fractionated, reconstituted and supplemented with 0.1% myristic acid to resemble the proportions in corn oil, no such difference was obtained. By employing equivalent amounts of fat in the form of whole corn germ, expressed corn oil or hexane extracted corn oil, the 6-week plasma cholesterol levels were 251 ± 29, 632 ± 98, and 905 ± 127 mg%, and the grade of aortic atherosclerosis varied accordingly. Corn oil and particularly the whole corn germ restricted the hypercholesteremic response to cholesterol feeding. This effect cannot be explained by the fatty acid composition alone.—Authors. (Biological Abstracts)

KANTIENGAR, N. L., J. S. LOWE, R. A. MORTON, and **G. A. J. PITT.** (U. Liverpool, Eng.)

THE EFFECTS OF ADMINISTERING CHOLESTEROL AND CHOLESTA-3:5-DIEN-7-ONE TO COCKERELS. *Biochem. Jour. 60(1):* 34-39. 1955.—Cockerels maintained from the 8th to the 16th week of age on diets containing cholesterol (2 g/bird/day) or cholesta-3:5-dien-

7-one (0.33 g/bird/day) were compared with control birds on the unsupplemented diet. Blood cholesterol remained between 105 and 152 mg/100 ml whole blood for controls and "dienone"-fed birds, but reached 526-860 mg/100 ml for those given cholesterol. The cholesta-3:5-dien-7-one was poorly absorbed and there was no significant change, compared with controls, in liver unsaponifiable matter, liver cholesterol or liver vitamin A. The intestines were much heavier than those of controls, and contained a larger amount of total unsaponifiable matter and of cholesterol. Cholesterol-fed birds had enlarged fatty livers with a more than tenfold rise in unsaponifiable matter (nearly all due to cholesterol) compared with controls. Nearly 40% of the liver vitamin A store was lost. The liver and intestine unsaponifiable matter contained respectively 16-18 mg and 6-7 mg of cholesta-3:5-dien-7-one. This material is regarded as a metabolite and not a laboratory artifact. The presence of a substance showing lambda maxium 272 mμ (in light petroleum) in the livers of all 3 groups of cockerels provides additional evidence that the material is a normal constituent. It is accompanied by a substance of similar chromatographic properties which gives rise to an absorption band near 315 mμ in concentrated H_2SO_4.—Auth. summ. (Biological Abstracts)

KARE, MORLEY R., ROBERT BLACK, and **E. G. ALLISON.** (Cornell U., Ithaca, N. Y.)

THE SENSE OF TASTE IN THE FOWL. *Poultry Sci. 36(1):* 129-138. Illus. 1957.—An experimental method for evaluating the response of chicks to various flavors is described. Results are drawn from 200 trials employing over 4000 individual animals. Data indicate that the chick has a sense of taste. The response to dilute solutions of flavor and to small alterations in concentration support the contention that this sense in the fowl is more than rudimentary. The response to a variety of sweet and bitter flavors suggests that the broad classifications of taste as recognized by man are not applicable to the fowl.—*M. R. Kare.* (Biological Abstracts)

KEANE, K. W., R. A. COLLINS, and **M. B. GILLIS.**

ISOTOPIC TRACER STUDIES ON THE EFFECT OF VITAMIN D ON CALCIUM METABOLISM IN THE CHICK. *Poultry Sci. 35(6):* 1216-1222. 1956.—Vitamin D markedly increased the absorption and retention of Ca^{45} given orally to chicks. However, it appeared to have no significant effect on the metabolism of intramuscularly injected Ca^{45}. This indicated that the primary effect of vitamin D on Ca metabolism was on absorption from the intestine. This is supported by in vitro studies with surviving intestinal mucosa cells. Cells from vitamin D-deficient chicks absorbed less Ca^{45} than similar cells from non-deficient chicks.—*M. B. Gillis.* (Biological Abstracts)

LATORRE, GLAUSER, L. Determinacion microbiologica de la vitamina B_{12} en harinas de pescado nacionales y de los Estados Unidos de América, y en otros alimentos de las aves.

MICROBIOLOGICAL ESTIMATION OF VITAMIN B_{12} IN SPANISH FISHMEALS AND OTHERS FROM THE UNITED STATES, AND IN OTHER POULTRY FEEDINGSTUFFS. *An. Bromatol., 1956, 8,* 343-344. [Dept. Zootec., Fac. Vet., Cordoba.] English summary.—The vitamin B_{12} content, estimated microbiologically, in Spanish fishmeals was on the average 113.31 ± 25.78 mμg. per g., extreme values 16.03 and 296.1. Prolonged high temperatures and the action of the sun during natural drying destroy part, sometimes much, of the vitamin B_{12}. The coefficient of variability in the national fishmeals was 67.74 per cent. The coefficient of correlation between the protein and vitamin B_{12} contents of all samples analysed was $r = + 0.624$. The fishmeals of which samples were analysed would cover the vitamin B_{12} requirement of poultry if given in the usual proportion of 10 to 15 per cent of the dry mixture.—*M. B. Richards.* (Nutrition Abstracts and Reviews)

MACHLIN, L. J., and P. B. PEARSON. (Agric. Res. Center, Beltsville, Md.)
STUDIES ON UTILIZATION OF SULFATE SULFUR FOR GROWTH OF THE CHICKEN. *Proc. Soc. Exptl. Biol. and Med. 93(2):* 204-206. 1956.—The addition of 0.5% sodium sulfate to a diet low in sulfur was found to stimulate the growth of the young chicken. Approximately 23% of the S^{35} of $Na_2S^{35}O_4$ was incorporated into the tissues after 1 week of feeding. Of this amount about 19% was present as taurine S^{35}. After feeding the sodium sulfate for 2 weeks a larger proportion of the S^{35} was recovered as taurine and significant amounts of S^{35} were present in the cystine and methionine.—Authors. (Biological Abstracts)

MARCH, B., and JACOB BIELY. (U. Brit. Columbia, Vancouver, Canada.)
FAT STUDIES IN POULTRY. 6. UTILIZATION OF FATS OF DIFFERENT MELTING POINTS. *Poultry Sci. 36(1):* 71-75. 1957.—Corn oil, tallow and hydrogenated animal fat were studied as supplements to chick rations. Corn oil and tallow were well utilized by the chick. The coefficients of digestibility were not so high as those reported in the literature because fatty acids excreted in the form of soaps were taken into account in the present experiments. When fed at the 12% level the values obtained were approximately 90% for corn oil and 73% for tallow. Two samples of hydrogenated animal fat fed at the 12% level were utilized only to the extent of 44 and 23%, respectively. Although there were differences in the distribution of fatty acids in the feces between split and intact fat when lecithin or Santomerse-80 was added to rations supplemented with either tallow or hydrogenated animal fat, there was no appreciable improvement in the digestibility of either fat. The greater part of fat excreted was in the form of soaps and free fatty acids. Chicks fed hydrogenated animal fat excreted a higher proportion of fat as triglyceride than did chicks fed the less saturated tallow. Highly saturated fats are evidently resistant to hydrolysis in the chick. Fecal soaps must be considered in any estimation of digestibility of fat by the chicken.—*B. March.* (Biological Abstracts)

MECCHI, E. P., M. F. POOL, G. A. BEHMAN, M. HAMACHI, and A. A. KLOSE. (Agric. Res. Serv., U. S. Dept. Agric., Albany 10, Calif.)
THE ROLE OF TOCOPHEROL CONTENT IN THE COMPARATIVE STABILITY OF CHICKEN AND TURKEY FAT. *Poultry Sci. 35(6):* 1238-1246. 1956.—Chickens and turkeys were maintained on the same diet, with and without alpha-tocopherol supplements, for various periods. The resulting carcasses were analyzed for fatty acid composition, tocopherol content, and stability of fat. With birds on a natural dietary level of tocopherol, the efficiency of deposition of tocopherol in the carcass fat was much greater for the chicken than for the turkey, and stabilities were in corresponding order. A dietary supplement of 0.1% alpha-tocopherol for periods of 5 and 10 weeks increased the tocopherol content and stability (induction period) of carcass fat in both species, but the superiority of chicken over turkey was maintained or enhanced. The stabilizing effect of alpha-tocopherol supplements was confirmed by chemical and organoleptic tests on carcasses stored at +10°F for 9 months. There was no appreciable difference in fatty acid composition of depot fats between chickens and turkeys fed the same diet. It was concluded that tocopherols play a major role in establishing the stability of poultry fat which is confirmed by additional measurements of induction periods of turkey fat before and after removal of tocopherol.—*E. P. Mecchi.* (Biological Abstracts)

MURTY, V. N., and S. G. IYER. (Poultry Res. Div. Indian Vet. Res. Inst., Izatnagar, India.)
CASSIA TORA LINN SEEDS IN POULTRY RATIONS. *Poultry Sci. 36(1):* 210-211. 1957.—An investigation was undertaken to study the possibility of incorporating *Cassia tora* Linn seeds in poultry rations. From the metabolic data collected on two groups of birds, one serving as the control consisting of 4 birds and the other group with 8 birds

fed the same control ration in which 10% is replaced by crushed *Cassia tora* Linn seeds, it is concluded that *Cassia tora* Linn seeds can be incorporated to an extent of 10% in poultry ration without any adverse effects on general health and metabolism.—*V. N. Murty.* (Biological Abstracts)

PETERSEN, C. A., A. C. WIESE, G. J. ANDERSON, and **C. E. LAMPMAN.** (U. Idaho, Moscow.)

THE USE OF SAFFLOWER OIL MEAL IN POULTRY RATIONS. *Poultry Sci. 36(1):* 3-8, 1957.—Decorticated safflower oil meal which contained 35% protein was studied to determine its value in replacing soybean oil meal in rations for chick growth and for egg production. Ratios of soybean to safflower oil meal protein of 1:3, 1:1, and 3:1 were studied in chick starter diets which also contained 5% fish meal and either 5 or 10% meat meal. There was no significant difference between treatments in body weights of experimental chicks at 6 weeks of age. Safflower meal was included in rations of laying hens to replace either 0.5 or all of the soybean oil meal. These rations also contained either 2.5% fish meal and 7.5% meat meal or 14.5% meat meal. There was no significant difference in results obtained from the various dietary treatments as measured by egg production, egg size, body weight, feed efficiency, or livability. There did appear to be a trend for reduced egg production with the higher levels (15 and 20%) of safflower oil meal.—*C. F. Petersen.* (Biological Abstracts)

PRELLER, J. H. and **C. L. MARAIS.**

GRASS-CLOVER PASTURE FOR CHICKS. *Farming in S. Africa, 1956, 32,* No. 8, 62-65. [Coll. Agric., Potchefstroom.]—From 8 weeks to sexual maturity chicks on a basal ration of balanced mash and yellow maize and either grazing on ryegrass and clover pasture or supplied with green feed from that pasture made better gains than those on the basal ration alone, and there was little difference between the pasture and green feed groups. In a second experiment a ration of skimmed milk and maize gave better growth when the chicks were grazing than when the pasture was supplied as green feed, and replacement of the milk in the latter group by a balanced mash did not improve growth rate.

When the experiment was repeated in the following year, after the ryegrass had been removed from the pasture, the best results were obtained with a ration of balanced mash, yellow maize and green pasture as grazing and the poorest results from skimmed milk, maize and green feed. Total cost of feed, however, was lowest in the groups given milk and mortality was also lowest. Chickens eating ryegrass developed "sour crop".—*J. S. Thomson.* (Nutrition Abstracts and Reviews)

RASMUSSEN, R. A. (Hiram Walker and Sons, Inc., Peoria, Illinois), **PAUL W. LUTHY, J. M. VAN LANEN,** and **C. S. BORUFF.**

MEASUREMENT AND DIFFERENTIATION OF UNIDENTIFIED CHICK GROWTH FACTORS USING A SEMI-PURIFIED RATION. *Poultry Sci. 36(1):* 46-54. 1957.—A chick basal ration of the following percentage composition was devised for measuring growth responses to different levels and to different combinations of unidentified chick growth factor sources: Cerelose 56.18, corn oil 0.25, blood meal 17.5, soybean meal (Hi Pro Con) 14, gelatin 3.5, Stamino (10% isoleucine) 2, methionine 0.3, vitamin mixture 1.1 and mineral mixture 5.17. Growth responses were obtained with alfalfa meal, whey, grain distillers dried solubles, residue of extracted liver and fish solubles. Combinations of these supplements fed at their maximum response levels indicated the existence of one unidentified factor in alfalfa and whey, a second in the residue of extracted liver and fish solubles and a third in grain distillers dried solubles. Adjustment of basal and supplemented rations to equicaloric content (1077 cal. productive energy/lb.) improved feed efficiency and gave slightly better growth. Chicks on this basal ration also responded to penicillin mycelium, corn steep liquor, animal peptone, BY-100 (riboflavin supplement) and vitamin B_{12} concentrate but not to molasses distillers solubles, Vigofac or the ash of grain

distillers dried solubles.—*J. M. Van Lanen.* (Biological Abstracts)

REED, A. and **J. VELU.**
THE EFFECT OF AUREOMYCIN AND VITAMIN B_{12} ON THE GROWTH RATE OF CHICKS. *Indian J. Vet. Sci., 1956, 26,* 135-138. [Allahabad Agric. Inst., U.P.]—Locally produced White Leghorn chicks, 3 days old, in 8 groups of 11 each were fed to appetite on a basal ration in common use, of ground yellow maize, wheat bran, groundnut cake, fishmeal and lucerne, with minerals and shark liver oil. Half the birds got a supplement of Aurofac giving 9 g. chlortetracycline and 9 mg. vitamin B_{12} per ton feed. Weights and feed consumptions were recorded weekly from 2 to 6 weeks of age. From initial weights of 47.6 and 47.2 g. in unsupplemented and supplemented birds, respectively, final weights of 211.1 and 242.1 g. were attained, giving a significant difference. Efficiency was also significantly improved, 67.2 and 71.4 g. gain in unsupplemented and supplemented groups per lb. feed eaten.

There was wide variation among chickens and the recorded growth rates were less than reported for similar chickens in the literature. This is discussed.—*T. D. Bell.* (Nutrition Abstracts and Reviews)

REID, B. L., A. A. KURNICK, R. L. SVACHA, and **J. R. COUCH.** (Texas A. & M. Coll., College Station.)
THE EFFECT OF MOLYBDENUM ON CHICK AND POULT GROWTH. *Proc. Soc. Exptl. Biol. and Med. 93(2):* 245-248. 1956.—The addition of molybdenum to a synthetic basal diet for chicks and poults containing 0.972 and 1.58 ppm of molybdenum, respectively, was found to result in growth increases of 13.5 to 19.1% in 3 experiments reported. A reconstituted ash mixture which simulated the ash of distillers dried solubles produced growth responses equivalent to distillers dried solubles ash. Results of these studies indicate that a portion of the growth promoting activity of the ash of distillers dried solubles may be attributed to molybdenum.—*B. L. Reid.* (Biological Abstracts)

RITCHEY, S. J., H. M. SCOTT, and **B. CONNOR JOHNSON.** (U. Illinois, Urbana.)
ADENOSINE AND ASH AS UNIDENTIFIED CHICK GROWTH FACTORS IN FISH MEAL. *Proc. Soc. Exptl. Biol, and Med. 93(2):* 326-328. 1956.—It was found that adenosine at 150 mg/kg of ration failed to stimulate chick growth when supplementing a 30% protein, soy protein type purified diet. Supplementation of such rations with 2% fish meal ash gave only small and variable responses, while supplementation with 10% fish meal uniformly gave marked growth response.—*S. J. Ritchey.* (Biological Abstracts)

SUNDE, M. L., and **H. R. BIRD.** (U. Wisconsin, Madison.)
THE NIACIN REQUIREMENT OF THE YOUNG RINGNECK PHEASANT. *Poultry Sci. 36(1):* 34-42. Illus. 1957.—The observation was made during the studies with pheasants on unidentified growth factor experiments that the addition of torula yeast decreases the incidence of a leg disorder. This disorder appeared as early as the end of the first week when the young pheasant was kept in batteries. No disorder was seen when the same diets were fed to pheasant chicks in floor pens. The disorder caused a bending and sometimes a twisting of the tarsometatarsus (shank). A swelling of the hock also occurred. Perosis also was observed. On the average 50-70% of the pheasants on the basal diet showed this leg disorder. Crystalline niacin reduced the incidence of the disorder to about 10%. The basal diet contained 30 mg/kg of ration (microbiological analysis). Additions of niacin to the basal diet were made from 0 to 160 mg/kg of ration. Data indicated that the requirement of niacin for the young pheasant was 50 mg of total niacin per kg of ration. Additions of alpha tocopherol acetate or diphenyl-p-phenylenediamine (DPPD) to the basal diet did not affect the incidence of the disorder. The combination of the alpha tocopherol acetate or DPPD and niacin resulted in a reduction of the percent leg disorder which in most instances was lower than that for niacin addition alone. Combinations of torula yeast and vitamin E or DPPD also decreased the

incidence of the leg disorder to low levels. Pheasant chicks fed crumbled feed appeared to grow faster than those fed the same material in the mash form. Pheasants reared in batteries grew faster than those reared in small colony houses.—*M. L. Sunde.* (Biological Abstracts)

WISEMAN, R. F., W. B. SARLES, D. A. BENTON, A. E. HARPER, and **C. A. ELVEHJEM.**

EFFECTS OF DIETARY ANTIBIOTICS UPON NUMBERS AND KINDS OF INTESTINAL BACTERIA IN CHICKS. *J. Bacterial., 1956, 72,* 723-724. [Dept. Bacteriol., Univ. Wisconsin, Madison.]—Groups of day-old chicks were fed on a semi-synthetic ration supplemented with folic acid at levels of 500 μg. per cent., "high-folic-acid", or 25 μg. per cent., "folic-acid-deficient", or on the folic-acid-deficient ration supplemented with 2.5 mg per cent. bacitracin and 10 mg. per cent. penicillin. Birds were killed at intervals and the contents of the ileum and caecum were sampled.

Growth was poorest in the folic-acid-deficient group. The intestinal contents of the high-folic-acid and folic-acid-deficient groups contained 1×10^7 or more lactobacilli per g. wet weight, those of the antibotic group less than 1×10^2. In the antibiotic group there was a slight increase in *Bacterium coli* and a pronounced increase in aerobacter species; there was also an increase in paracolon bacteria. When the high-folic-acid group was transferred to the ration of the folic-acid-deficient group with antibiotic supplement, lactobacillus count fell and aerobacter count rose. When the antibiotic group was changed to the high-folic-acid ration lactobacillus count rose and aerobacter count fell.

These results agree with those reported by Rhodes *et al.* (Abst. 1011, Vol. 25) who concluded that antibiotics depress the vitamin-requiring bacteria and increase the vitamin-synthesising micro-organisms.—*J. S. Thomson.* (Nutrition Abstracts and Reviews)

WISMAN, E. L. (Virginia Polytech. Inst., Blacksburg), **R. W. ENGEL,** and **C. E. HOLMES.**

INDOLE TOLERANCE AND THE INFLUENCE OF AUREOMYCIN IN THE GROWING CHICK. *Poultry Sci. 36(1):* 139-143. 1957. —Data suggest that the chick is highly tolerant to indole and that antibiotics do not stimulate growth by influencing the amount of indole occurring in the intestine. Inclusion of crystalline indole in the diet at the level of 450 mg/lb. did not depress growth between 4 and 8 weeks of age, even though indole was greatly increased in the excreta and appeared in the liver. Twice this level of indole-intake markedly retarded growth and produced correspondingly more indole in the excreta and liver. The amount of excreted indole was positively correlated with ingested indole. Approximately 99% ingested indole was apparently absorbed and detoxified by the liver. The presence of Aureomycin in the diet at low or high levels did not affect the occurrence of indole in the chick. A growth response, however, was obtained only with a high level antibiotic.—*E. L. Wisman.* (Biological Abstracts)

PATHOLOGY

HORTON-SMITH, C. and **P. L. LONG.** (Houghton Poul. Res. Sta., Houghton, Huntingdon, England.)

ASCARIDIA DISSIMILIS VIGEURAS, 1931, IN BRITISH TURKEYS. *The Veterinary Record 69:* 436.—So far as we can ascertain, *A. dissimilis* has not previously been recorded in Britain. Although we have no grounds for suspecting that *A. dissimilis* is the predominant ascarid species in turkeys in this country it is possible that all ascarids hitherto recovered from turkeys have been assumed, incorrectly, to be *A. galli.*—(Authors)

JOYNER, L. P., and S. F. M. DAVIES. (Vet Lab. Min. Agric., Weybridge, Eng.)

SULPHAQUINOXALINE POISONING IN CHICKENS. *Jour. Comp. Path. and Therap. 66(1):* 39-48. 1956.—The greater susceptibility of chicks at 4-8 weeks of age cannot be attributed to greater absorption of the drug at that age. The increase of blood clotting time following administration of the drug does not vary with age of the birds. There was a close correlation between the concentration of sulphaquinoxaline in the blood and the blood clotting time. Vitamin K or synthetic analogues reduced the clotting time but did not reduce the incidence of lesions. Dietary supplements of para-amino-benzoic acid or injections of ascorbic acid, vitamins A, B_1 B_2, D, K, riboflavine, and panthothenic acid did not reduce the incidence of lesions.—*W. B. Bell.* (Biological Abstracts)

SMITH, H. W. and **L. G. CHUBB.** (Houghton Poultry Research Station, Houghton, Huntington, England)

THE EFFECT OF FEEDING DIFFERENT LEVELS OF PROTEIN CONCENTRATES ON THE SUSCEPTIBILITY OF CHICKENS TO *SALMONELLA GALLINARUM* INFECTION. *The Journal of Comparative Pathology and Therapeutics 67:* 10-20.—The results of feeding chickens diets of ground wheat containing different amounts of fish meal commencing three weeks before infection indicated that the diet which produced the greatest resistance to *Salm. gallinarum* infection was one of ground wheat plus 2½ per cent fish meal. The absence of fish meal, or its addition at higher levels (10 and 40 per cent), had an adverse effect on the course of the disease. A high level of decorticated ground nut meal (50 per cent) produced a similar effect.

Changing the diet from one of ground wheat containing high levels of fish meal to one composed of ground wheat only at, or preferably three days before, infection had a beneficial influence on the course of the disease. This was not true of dietary changes in the reverse direction.

Fasting chickens for 48 hours before infection had no observable effect when infection was produced parenterally. When produced orally, however, the disease was somewhat more severe in chickens fasted for 48 hours than in chickens fasted for shorter periods of time.—(Authors)

POULTRY PRODUCTS AND MARKETING

ABBOT, J. C.

SUB-SCALD POULTRY PROCESSING. *Food Engineering 27(1):* 96-102. 1955.—Advantages of sub-scalding poultry to remove feathers, that is by using a water temperature of 138-140°F, are as follows. Hand picking and finishing lines are eliminated, pin feathers present no problem and this means younger birds can be processed, and sub-scalded birds have greater consumer appeal. To preserve the white color of the meat after sub-scalding, the eviscerated bird is packaged in a vacuumized plastic bag and quick frozen.—*J. J. Licciardello.* (Biological Abstracts)

BANWART, S. F., A. F. CARLIN, and **O. J. COTTERILL.** (Iowa Agric. Expt. Sta., Ames.)

FLAVOR OF UNTREATED, OILED AND THERMOSTABILIZED SHELL EGGS AFTER STORAGE AT 34°F. *Food Technol. 11(3):* 200-204. 1957.—Untreated, oiled and thermostabilized eggs stored at 34°F were evaluated at monthly intervals up to 8 months to determine differences in the interior quality and in flavor deterioration. During storage, eggs from all treatments declined significantly in interior quality as measured by Haugh units. Untreated eggs declined more in quality than did treated eggs. A highly significant negative correlation existed between length of storage and decrease in the flavor scores of both untreated and treated eggs. As storage time increased, off-flavors were more evident in oiled and in thermostabilized eggs than

in untreated eggs. After 6 months the flavor of the stored untreated eggs was superior to that of the stored treated eggs, when such eggs were scrambled or soft-cooked.—*Frances Carlin.* (Biological Abstracts)

BEISEL, C. G.

HI-VAC UPS OUTPUT. *Food Engineering 26(7):* 60-61, 189, 1954. —Cooked chicken can be cooled in 20 minutes to 60°F by being subjected to a vacuum of 29 inches of Hg. A flow sheet for production of frozen poultry pies is included.—*J. J. Licciardello.* (Biological Abstracts)

COTTERILL, OWEN J., and **FRED GARDNER.** (Iowa State College, Ames.)

RETARDING THICK WHITE DETERIORATION BY HOLDING SHELL EGGS IN SEALED CONTAINERS. *Poultry Sci. 36(1):* 196-206. 1957.—Under the conditions of these experiments, gathering eggs in a container, like a bucket which can be sealed, was more effective in retaining interior quality than gathering eggs in a basket. Holding eggs in a sealed container at room temperature resulted in excessive microbiological development on the shell surface. This microbial proliferation can be controlled by including a desiccant in the container to lower the relative humidity. The dried diatomaceous earth product used in these trials were inert to CO_2 and did not excessively dehydrate the eggs. The principles regarding the conservation of the inherent CO_2 of the egg or the addition of CO_2 have many possibilities for application throughout the marketing channels.—*O. J. Cotterill.* (Biological Abstracts)

DAWSON, L. E., J. A. DAVIDSON, MARY A. FRANG, and **SUE WALTERS.** (Michigan State U., East Lansing.)

RELATIONSHIP BETWEEN MEAT-TYPE SCORE AND PERCENTAGE OF EDIBLE MEAT IN MINIATURE CORNISH-CROSS BROILERS. *Poultry Sci. 36(1):* 15-18. Illus. 1957.—Five replications of 5 different meat type miniature broilers were used in this study. Individual pedigreed Cornish-Cross birds were slaughtered and processed at 6 weeks of age and then classified according to meat type. Each bird weighed approximately 16 ounces dressed (without giblets). Each bird was then cooked on a rack in an eight-inch round aluminum pan for 1 hour in an oven at 163°C (350°F). All edible meat was separated from bones. Total cooking loss, as a percentage of raw weight, varied from 22.72 to 24.54%. No consistent relationship between meat-type and cooking loss or total yield was noted. The yield of edible cooked meat varied directly with the meat-type. The birds of superior meat-type yielded 5% more edible cooked meat and 5% less bone than did the birds of lowest meat-type. Based on pound-sized raw weights of broilers of the 5 meat-types used, approximately 50% of the raw weight was edible cooked meat, 22% was bone, 23% was lost in cooking and 5% was lost in separating the meat from the bone.—*L. E. Dawson.* (Biological Abstracts)

MECCHI, E. P., M. F. POOL, M. NONAKA, and **A. A. KLOSE.** (Western Utilization Res. Branch, Agric Res. Serv., U. S. Dept. Agric., Albany 10, Calif.)

FURTHER STUDIES ON TOCOPHEROL CONTENT AND STABILITY OF CARCASS FAT OF CHICKENS AND TURKEYS. *Poultry Sci. 35(6):* 1246-1251. 1956.—Chickens and Beltsville White turkeys grown on the same diet were compared at 10, 17, and 24 weeks of age for fatty acid composition, tocopherol content, and stability of their crude fat. Analyses of the depot fats confirmed previous studies, in that alpha-tocopherol deposition and stability were greater in chicken fats than in turkey fats. One and 2 week supplementation of the diet with alpha-tocopherol increased tocopherol content and stability to a marked extent in chickens but only slightly in turkeys. Fatty acid composition of depot fats was essentially the same for chickens and turkeys, with some differences in clupanodonic acid which was present at very low concentrations. Data for the 2 species, together with additional tests of mixtures of depot fats with pure alpha-tocopherol,

suggest that there are factors in addition to contents of crude tocopherol and the commonly occurring fatty acids that contribute to differences in stability of chicken and turkey fat.—*E. P. Mecchi.* (Biological Abstracts)

MILLER, WILBUR H. (Amer. Cyanamid, N. Y. C.)
INTRODUCE NEW METHOD TO KEEP POULTRY FRESH. *Food in Canada 16(2):* 32, 34, 36, 38. 1956.—Poultry cooled in an ice-slush mixture containing 10 ppm of chlortetracycline absorb sufficient antibiotic to maintain freshness from 14-21 days when the birds are packaged as they are removed from the cooling bath and then stored under commercial refrigeration. Field trials with fish and beef are also discussed. Residual chlortetracycline becomes inactived beyond the point of detection under every conceivable method of normal cooking of poultry.—*R. H. Haskins.* (Biological Abstracts)

RHODES, D. N. and **C. H. LEA.**
PHOSPHOLIPIDS. 4. ON THE COMPOSITION OF HEN'S EGG PHOSPHOLIPIDS. *Biochem. J., 1957, 65,* 526-533. [Low Temp. Res. Stat., Univ. Cambridge.]—Crude phospholipins extracted from hen's eggs were quantitatively separated into choline-containing and non-choline-containing fractions by chromatography on alumina. By further chromatography of each fraction on silicic acid the whole phospholipin was shown to consist of phosphatidyl choline 73.0, lysophosphatidyl choline 5.8, sphingomyelin 2.5, phosphatidylethanolamine 15.0, lysophosphatidylethanolamine 2.1 and inositol phospholipin 0.6 moles per cent. The lecithin fraction contained a small amount of plasmalogen and the phosphatidylethanolamine included traces of phospholipins containing amino acids.—*G. A. Garton.* (Nutrition Abstracts and Reviews)

SCHMIDT, G., M. J. BESSMAN, M. D. HICKEY, and **S. J. THANNHAUSER.**
THE CONCENTRATIONS OF SOME CONSTITUENTS OF EGG YOLK IN ITS SOLUBLE PHASE. *J. Biol. Chem., 1956, 223,* 1027-1031. [Res. Labs., Boston Dispensary, Mass.]—Yolks were separated within 24 hr. of eggs being laid and centrifuged at 12,000 r.p.m. until separation took place into a clear yellow supernatant fluid and a white sediment forming from 25 to 30 per cent of the total volume. Distribution was studied of N and P fractions, and of Fe and Ca. The supernatant plasma contained none of the protein P, about 13 percent of the total Ca and Fe in yolk and more than 70 percent. of the yolk phospholipins. The particulate fraction contained about 40 percent of the yolk proteins.—*D. Harvey.* (Nutrition Abstracts and Reviews)

SHANNON, WILLIAM G. (Purdue U., Lafayette, Indiana.) **W. W. MARION,** and **W. J. STADELMAN.**
EFFECT OF TEMPERATURE AND TIME OF SCALDING ON THE TENDERNESS OF BREAST MEAT OF CHICKEN. *Food Technol. 11(5):* 284-286. 1957.—Leghorn hens were used throughout the studies. Six levels of scald temperatures 120°, 135°, 150°, 165°, 180°, and 195°F were investigated. The 6 time-levels used were 5, 10, 20, 40, 80, and 160 seconds. Each temperature level was used in conjunction with a time level. Within the limits of this study time of scald and temperature of scald significantly reduced tenderness of poultry meat as does the interaction of time with temperature. Within the range of times and temperatures used in this study the effect of time was greater than that of temperature.—Authors. (Biological Abstracts)

SOLOMON, B.
NUCLEIC ACID CONTENT OF THE EGG OF THE DOMESTIC FOWL. *Biochim, biophys. Acta,* 1957, 23, 211-213. [Lab. Morphol. Animale, Univ. Libre, Brussels.]—Ribonucleic acid (RNA) extracted from egg by perchloric acid amounted to 68 μg. per yolk and 520 μg. per white, deoxyribonucleic acid (DNA) to 55 and 308 μg. Corresponding values obtained by phenol partition were RNA 114 and 1928, DNA 39 and 140. —*A. Hepburn.* (Nutrition Abstracts and Reviews)

MANAGEMENT

FRANCIS, D. W. (New Mexico A. and M. Coll., State College.)
A COMPARISON OF SEVEN STRAINS OF PUREBREDS AND HYBRIDS IN CAGES. *Poultry Sci. 36(1):* 178-181. 1957.—An analysis of production traits over a 6-month period from the records of 14,000 cage layers representing 5 strains of S. C. White Leghorns and 2 hybrids was made. Data for hen-housed production, mortality, number culled, days to 50% production, feed per dozen eggs and egg size are given. Considerable variation was noted between the strains or hybrids for the production traits. The S. C. White Leghorns appeared to be able to adapt themselves to cages better than the hybrids as measured by the production traits.—*D. W. Francis.* (Biological Abstracts)

FRANCIS, D. W. (New Mexico A. and M. Coll., State College.)
STRAIN DIFFERENCES IN THE INCIDENCE OF CAGE LAYER FATIGUE. *Poultry Sci. 36(1):* 181-183. 1957.—The data from 12,336 pullets representing 7 strains of chickens kept in individual cages were analyzed for cage layer fatigue. The incidence of this syndrome varied from 0.65 to 3.95% between the strains. The differences between the strains were highly significant. Results of this analysis indicate the incidence of cage layer fatigue varies with different strains. Recovery by affected birds will also depend upon the strain and early identification and removal from the cages to floor pens.—*D. W. Francis.* (Biological Abstracts)

MORGAN, WALTER. (South Dakota State Coll., Brookings.)
EFFECT OF DAY-OLD DEBEAKING ON THE PERFORMANCE OF PULLETS. *Poultry Sci. 36(1):* 208-210. 1957.—First year performance of New Hampshire pullets, which were debeaked at hatching time, is compared with that of controls. The two degrees of debeaking were ½ of the upper beak removed and ⅓ of both beaks. No significant difference resulted amongst the three groups for growth during the first 5 months. The debeaked groups did not have more culls at time of housing than did the controls. Both debeaked groups averaged more eggs per bird housed than did the controls: an advantage of 11 eggs for the "½ upper" group and 18 eggs for the "⅓ both". Mortality from hatching-time to the end of the first year was slightly higher for the controls than for the debeaked groups.—*W. Morgan.* (Biological Abstracts)

WILSON, W. O., A. E. WOODARD, and **H. ABPLANALP.** 1956. (Dept. Poult. Husb., Univ. Calif., Davis.)
THE EFFECT AND AFTER-EFFECT OF VARIED EXPOSURE TO LIGHT ON CHICKEN DEVELOPMENT. *Biol. Bull.* [*Woods Hole*], *111:* 415-422.—Continuous light added to natural illumination had a favourable effect on the growth of S.C. White Leghorn chicks to at least 7 wks. of age, but at 20 wks. birds brooded under only natural light had significantly higher body weights. Testis weight at 7 wks. was significantly greater in ♂♂ exposed to continuous light. In pullets, sexual maturity appeared to be delayed by treatment. Continuous light also had an adverse effect on feathering. Under conditions of low light intensities and short periods of light exposure, the rate of sexual development increased with longer total daily exposure to light, greater light intensity, and more frequent stimulation. The effects of daily light exposures were greater when the pullets were over 90 days old at the time of treatment. (Animal Breeding Abstracts)

GENERAL

VOLKOV, A. A., and **N. A. GORJUNOV.** 1956. Sovetskoe pticevodstvo.
SOVIET POULTRY BREEDING. *Priroda* [*Mosk.*], *45(9):* 49-56.

—The number of hatcheries in the U.S.S.R. has increased from 527 in 1940 to over 2540 in 1955. Each year between 250,000,000 and 300,000,000 eggs of the various species are hatched at these hatcheries. Brief descriptions are given of recently formed breeds or breed groups of which there are 7 of fowls, 2 of turkeys, 5 of geese, and 4 of ducks. (Animal Breeding Abstracts)

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High-Energy Rations Must Supply Adequate Vitamin K

THE development of high-energy poultry rations has brought about a corrresponding reduction in supplies of natural vitamin K. It has also brought about the possibility of inadequate vitamin K supplies in many poultry feeds.

This possibility was first presented in 1953 through studies at the Universities of Illinois[1] and West Virginia.[2] Additional studies[3] substantiate this theory when vitamin K deficiencies are promoted through the feeding of simplified high-energy poultry rations.

Research at Abbott Laboratories suggested that KLOTOGEN F(R) (menadione sodium bisulfite) might prove more effective than ordinary menadione in treating and preventing the hemorrhagic syndrome in poultry. The suggestion was based on the fact that menadione sodium bisulfite was particularly successful as an anti-hemorrhagic agent in humans, without need for bile salts.

First tests[4,5] bore out the superior absorbability of the water-soluble form of vitamin K. Effectiveness of the compound by injection was dramatically demonstrated in field studies in Israel.[6] These same tests also called attention to increased vitamin K requirements when heavy sulfa medications were used.

Early tests[5] established KLOTOGEN F to be at least four times as effective as menadione in the presence of excess sulfa, in a vitamin K-low diet. Further studies[7] showed KLOTOGEN F to be six to 10 times as effective as menadione as the total source of vitamin K in simplified rations with high-level sulfa. Further, KLOTOGEN F, containing only one-third menadione by composition, was three times as effective as menadione as the total source of vitamin K, even in the absence of sulfa medicaments. Recent work at West Virginia[8] showed a six-time ratio of activity for KLOTOGEN F over menadione, i.e., 18 times as effective on a menadione equivalent basis.

"Hemorrhagic disease" in poultry appears to have been frequently caused by marginal vitamin K deficiencies—brought about in isolated instances by circumstances which created unusual needs for the vitamin. Water-soluble vitamin K (KLOTOGEN F) proved itself a useful agent for prevention of this "disease" condition. KLOTOGEN F helped to assure the safe use of the highly effective and valuable coccidiostats when the vitamin K adequacy of the rations was in doubt.

The need for adequate vitamin K in all poultry feeds is well established. The unusual activity discovered for KLOTOGEN F, plus the relative ease and safety of handling, together with its proved stability, have made it a superior product to assure the vitamin K adequacy of poultry rations.

KLOTOGEN F is one of the developments by Abbott Laboratories for improvement of poultry and animal health. For full information on KLOTOGEN F, write to Abbott Laboratories, Nutrition Research Division, North Chicago, Illinois.

REFERENCES

1. Griminger, P.; Fisher, H.; Morrison, W. D.; Snyder, J. M.; and Scott, H. M.: *Science*, 118:379, 1953.
2. Hare, J. H.; Anderson, C. E.; and Weakley, C. E., Jr.: *Poultry Science*, 32: 904, 1953.
3. Anderson, G. C.; Hare, J. H.; Bletner, J. K.; Weakley, C. E., Jr.; and Mason, J. A.: *Poultry Science*, 33: 120, 1954.
4. Goldhaft, T. M., and Wernicoff, N.: *Tenth World's Poultry Congress, Edinburgh*, p. 278, 1954.
5. Frost, D. V.; and Spruth, H. C.: *Poultry Science*, 34: 56, 1955.
6. Bornstein, S.; and Samberg, Y.: *Poultry Science*, 33: 831, 1954.
7. Frost, D. V.; Perdue, H. S.; and Spruth, H. C.: *The Journal of Nutrition*, 59: 181, 1956.
8. Shelton, D. C.; Anderson, G. C.; Clark, T. B.; and Weakley, C. E., Jr.: *Abstracts of Papers, 45th Annual Meeting, Poultry Science Assn.*, p. 43, Aug. 7-10, 1956.

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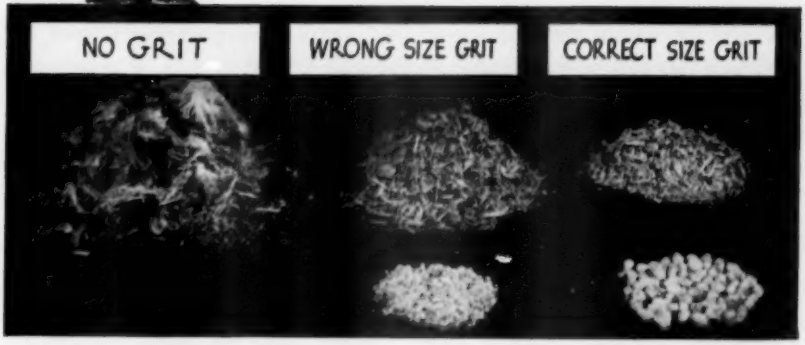

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The Whitmoyer Diagnostic Laboratory first became aware of the increasing incidence of this disease several years ago. As a result, a research project was set up at that time to develop a product which would effectively treat the condition without the threat of undesirable side or after-effects.

Thus, Whitmoyer Laboratories were ready with a safe, effective treatment for blackhead in chickens when the poultry industry needed it.

HISTOCARB* — is another achievement of the "look ahead" research which has enabled Whitmoyer to provide "Products of Scientific Merit" to the poultry industry for over a quarter of a century.

HISTOCARB*—is a fast-acting, safe treatment for blackhead in chickens. It does not cause any undesirable side or after-effects; does not delay or reduce egg production. HISTOCARB mixes uniformly with mash . . . can be used with the coccidiostats, arsenicals and the antibiotics normally mixed with feeds.

Another product, CARB-O-SEP*—has been developed specifically for preventing blackhead in turkeys without undesirable side reactions. Unlike many mash medications, CARB-O-SEP does not make the mash less palatable. It has no adverse effect on feed consumption, rate of growth, feathering, appearance or finish. Birds continue to make normal weight gains.

Your request for additional data on these—or other Whitmoyer products—is always most welcome. You are cordially invited to consult with our staff members on poultry health or nutritional matters.

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To answer questions from poultry pathologists, veterinarians and extension workers about NICARB, Merck research, production and technical service people regularly hold round-table discussions. The questions that follow represent points of immediate concern to the professions. The answers are based on published studies and unpublished data in Merck files.

Q. Are there any large-scale figures to show the economic effects of two years of commercial use of NICARB?

A. This point was the object of a study in Delaware and four Southern states (Alabama, South Carolina, Georgia, and Mississippi). In the latter case, the incidence of coccidiosis was reduced 68% reflecting savings of $1,832,000 amongst the 283,305,000 birds in the southeastern area. This reduction was directly attributable to NICARB at no increase in coccidiostat cost to the poultry industry. Savings would have been even greater if the extent of use of NICARB had been as great in the southern area as in Delaware.

Q. What characteristics of NICARB especially appear to influence the degree of immunity developed by exposed birds?

A. Studies show that NICARB specifically suppresses the development of second generation schizonts. The presence of these retarded and encysted schizonts produces a reaction in the intestinal tissues. This reaction appears to stimulate immunity and may account for the high degree of resistance to reinfection with coccidia found in chickens fed NICARB. *J. Parasitology* **42**:593.

Q. Is there really an acoccidial condition in the poultry industry?

A. In many areas in the past few years, weather conditions have often not been favorable to the development of coccidiosis. It is also a fact that the widespread use of NICARB with its limiting effect on oocyst production tended to decrease the weight of exposure to coccidia. However, in areas reporting an acoccidial condition with, following, or in the presence of NICARB, there have been enough breakthroughs when other coccidiostats were used to suggest that what looks like an acoccidial condition is at best subclinical coccidiosis and at worst a costly break. *Personal communications.*

Q. How lasting are the effects of feeding NICARB to pullets or hens?

A. All adverse effects of accidental feeding of NICARB to pullets and hens are temporary. Depigmentation or brown-shelled eggs and mottling of egg yolks are quickly reversed by withdrawal of the drug. Hatchability takes a little longer to return to normal, usually within 2 to 3 weeks. *Poultry Science* **35**:1355.

Q. What is the best feed conversion ratio reported with broilers raised with NICARB?

A. At the Missouri State Fair in 1956, Cornish White Rocks protected with NICARB attained an average weight of 3.58 pounds after nine weeks three days and needed only 1.97 pounds of feed per pound of gain. Experimental rations have equalled this record but the 1.97 figure is considered outstanding because it was made with commercial feed. Superior performance is theoretically possible; we should appreciate learning of specific instances. Merck & Co., Inc., Chemical Division, Rahway, N. J.

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